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AN INDEX

TO

ENGINEERING PERIODICALS,

1883 to 1887,

INCLUSIVE.

COMPRISING

ENGINEERING; RAILROADS; SCIENCE; MANUFACTURES AND TRADE.

BY

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PREFACE.

Progress in the development of material resources, in recent years, has created a large and increasing volume of engineering literature in periodicals which contain valuable papers and information, much of which is too recent, or fragmentary in character, to be found in books, or elsewhere.

This work is designed to make accessible to engineers in all branches of the profession, to special investigators, librarians, editors and others, the more important papers and articles contained in leading American and English periodicals during the last five years. To keep the list from becoming unwieldy, it was decided to limit, besides the period covered, the number of references to about ten thousand, and, with these restrictions, the compiler has selected each reference given by personal examination of the articles in the files, and has been enabled to include quite complete references to the periodicals named. He regrets that the prescribed limits do not enable him to also include the Proceedings of the Engineering Societies, and other valuable periodicals, in the present volume.

The index is by subjects, alphabetically arranged, and makes available information now practically buried in the mass of engineering literature, or only to be extracted by the aid of some one hundred and fifty different indices, and the loss of much time.

BOSTON, *May*, 1888.

NAMES OF PERIODICALS INCLUDED IN INDEX, AND ABBREVIATIONS.

Engineering News, *Eng. News;* Iron Age; Mechanics. *Mech.;* American Engineer, *Am. Eng.;* Sanitary Engineer, *San. Eng.;* Engineering and Building Record, *Eng. & Bu. Rec.;* Railroad Gazette, *Ry. Gaz.;* Van Nostrand's Engineering Magazine, *Van. Nost.;* Railroad and Engineering Journal, *Ry. & Eng.;* Journal of the Franklin Institute, *Fran. Inst.;* Street Railway Gazette, *St. Ry. Gaz.;* Electrician and Electrical Engineer, *Electric.;* Electrical Review, *Elec. Rev.;* Electrical World, *Elec. World;* Scientific American Supplement, *Sci. Am. Sup.;* The Locomotive, *Locom.;* Society of Arts Proceedings, Mass., *Soc. Arts;* Engineering (London), *Eng.;* The Engineer (London), *The Eng.*

OTHER ABBREVIATIONS.

addr. address.
agric. agricultural.
Am. American.
amt. amount.
anal. analysis.
ap. apparatus.
aqued. aqueduct.
ar. armor.
artif. artificial.
atmos. atmosphere.
aut. automatic.
bat. battery.
Bess. Bessemer.
Brit. British.
b's. boilers.
bu. building.
cal. calculating, calculation.
capac. capacity.
cath. cathedral.
C. E. civil engineer.
centrif. centrifugal.
chem. chemistry.
comp. compound.
condens. condensing, condensation.
corrug. corrugated.
Corp. Corporation.
Co's. Companies.
cyl. cylinder.
dec. decrease.
dept. department.
des. designer, design.
desc. description.
diam. diameter.
discov. discovery.
discuss. discussion.
distil. distillation.
distrib. distribution.

dyn. dynamometer.
econ. economy, economical.
effic. efficiency.
elec. electric.
eng. engine, engineer, engineering.
es. estimate.
estab. establishment.
evap. evaporation.
exam. examination.
excav. excavating, excavation.
exhib. exhibition.
exp. expense.
expt. experiment.
extin. extinguish, extinguishing.
frt. freight.
galv. galvanometer.
gen. generation.
gov. governor.
h. house.
H. P. horse power.
har. harbor.
hist. history.
hor. horizontal.
hos. hospital.
ht. height.
hydr. hydraulic.
illum. illuminating.
imp. improvement.
inc. increase.
incand. incandescent.
indus. industry, industrial.
ins. insurance.
Inst. Institute.
inv. inventor, invention.
locom. locomotive.
lub. lubricating, lubricants.
M. E. mechanical engineer.
mach. machine, machinery.
manuf. manufacture.
max. maximum.
meth. method.
min. minute.
mo. motive.
mt. mountain.
munic. municipal.
mut. mutual.
n. note.
nav. navigation.
obs. observations.
pass. passenger.
pat. patent.
pneu. pneumatic.
pop. population.
por. portrait.
press. pressure.
pro. proceedings.
proc. process.
prog. progress.
propul. propulsion.
pyrom. pyrometer.
R. railroad.
r. river.
recip. reciprocating.
refrig. refrigerating.
reg. regulator.
regen. regenerative.
rep. report.
res. residence.
resist. resistance.
Ry. railway.
san. sanitary.
sec. second.
Soc. Society.
spec. specification.
sq. square.
st. street.
stat. statistics.
stm. steam.
str. steamer.
sup. supplement.
sys. system.
teleg. telegraph.
teleph. telephone.
temp. temperature.
topog. topographical.
util. utilization.
vac. vacuum.
vel. velocity.
ventil. ventilation.
wks. works.
wrt. wrought.
wt. weight.

ENGINEERING INDEX.

NOTE.—The black faced figures refer to the years, as-**3**,=1883. Where no figure is given after date of month, the reference is in the year indicated by the next succeeding heavy face figure. When name of periodical is omitted before date of month the last preceding name is understood.

The mark "do." in every case, refers to the first word or subject only, in the reference immediately preceding; thus, under the word, ELECTRIC "welding, E. Thomson, *Soc. Arts*, Dec. 9.-**6**; do. *Eng.* Sep. 24" &c., the do. refers to welding only. When two such marks are used together, it indicates either the same subject and author, or that the first and second subjects, or more, of preceding reference are repeated.

When the same figures are repeated, in dates of months, as "St. Albans water wks., Aug. 17, 24, 24;" the article is to be looked for in two or more places, in the number of periodical of that date.

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" HENRY, D. H., h. Tuxedo Park, N. Y., *San. Eng.* Nov. 6-6.
" HOME FOR BLIND, N. Y., *San. Eng.* Mar. 19-7.
" HOSPITAL, Cambridge, Mass., *San. Eng.* Jan. 21-6; Children's, Cin. O., June 11-7; Civil, at Antwerp, Feb. 11-6; circular wards, Snell, Dec. 10-5; Cottage, (small), Burdett, Feb. 18; do. at Halstead, Apr. 8; do. May 27; do. June 24; Sep. 2; do. Sanitarium, Reedham Asylum, Sep. 30; do. St. Pauls, Cray, Kent, Nov. 20; do. Surbiton, Dec. 18-6; do. Jan. 8; do. Princess Alice Memorial, Eastbourne, May 14-7.

ARCHITECTURE, HOSPITAL, military, Aug. 13, 13-5; ship "Castalia," Apr. 29-6; Stratford-on-Avon, Feb. 26-7; plans, Hastings, St. Leonard's and E. Sussex, July 2; do. Methodist General, Sep. 3-7; Takhtsingji, Oct. 15, 15; Taylor, Moses, Hos., Oct. 29-5.

" HOTEL DE VILLE, St. Quentin, *Sci. Am. Sup.* Dec. 19-5; D'Almy, *San. Eng.* Sep. 24-7.

" HOUSE, design, *Sci. Am. Sup.* Dec. 29-3; Mottingham Park, Eltham, Nov. 10-3; suburban, Mar. 13-6; do. Hyde Park, Mass., *San. Eng.* Aug. 19-6; houses, Dec. 10-24-5, etc.; do. semi-detached, Boyden, Jan. 7-6; do. do. *Sci. Am. Sup.* Oct. 20-3.

" HOUSES OF PARLIAMENT, Vienna, *Sci. Am. Sup.* Mar. 15-4; do. quadriga for, Dec. 19-5; do. statuary for, Industry and Commerce, June 6-5; Buda Pesth, Feb. 28-5.

" HOWE'S, G., res. Manchester, Mass. *San. Eng.* Jan. 1-7.

" HULL GENERAL INFIRMARY, *San. Eng.* Aug. 21-4.

" HYDE PARK, Mass., h. *San. Eng.* Aug. 19-6.

" INSTITUTE OF PAINTING, London, *Sci. Am. Sup.* Sep. 1-3.

" IVES, H. C., h. *San. Eng.* Nov. 19-5.

" JACOBEAN style, h. in, *Sci. Am. Sup.* Aug. 30-4.

" KANSAS CITY EXCHANGE, BU., competition reps. *San. Eng.* July 29-6.

" KENSINGTON COURT, *Sci. Am. Sup.* June 12-6.

" KIRTLAND, J. C., res. Orange, N. J., *San. Eng.* Apr. 16-7.

" KOREAN, P. Lowell, *Soc. Arts*, Mar. 12-5.

" LAFAYETTE, N. J., res. *San. Eng.* Feb. 26-7.

" LALLEMANT HOTEL, Court, *San. Eng.* Oct. 8-4.

" LEACH, H. S., res. Saratoga Springs, *San. Eng.* Nov. 13-6.

" LEEDS, h. *Sci. Am. Sup.* Feb. 24-3.

" LISIEUX, Normandy, old h. at, *San. Eng.* July 8-6.

" LODGE, to private res. North Easton, Mass., *San. Eng.* Nov. 5-4; Mentmore entrance, Jan. 1; porter's, No. Andover, Mass., *San. Eng.* May 21-7; English, *Sci. Am. Sup.* Sep. 29-3.

" LONDON, Central Inst., So. Kensington, *San. Eng.* Aug. 30-4; St., old, view in, *San. Eng.* April 23-5.

" LONGLEAT, *Sci. Am. Sup.* Jan. 30-6.

" LONGWOOD, Mass., h. *San. Eng.* May 13-6; June 11-7.

" LORD GEO. L., h. Milwaukee, *San. Eng.* Mar. 25-6.

" LUMBER EXCHANGE, Minneapolis, *San. Eng.* Aug. 27-7.

" LYNCHBURG, Va., h. *San. Eng.* Mar. 19-7.

ARCHITECTURE, MANCHESTER-BY-SEA, Mass., h. *San. Eng.* Dec. 31-5; res. Apr. 29-6; Mar. 5-7.
" MANHATTAN CO., bank, N.Y., skylight, *San. Eng.* Feb. 19-5.
" MANUF. BU., *San. Eng.* Sep. 17-7.
" MARQUAND, H. G., res. N. Y. *San. Eng.* May 21-5.
" MASON, WM. P., and W. Sargent, res. Boston, *San. Eng.* Apr. 9-7.
" MCCORMICK THEOL. SEM., Chicago, *San. Eng.* July 2-7.
" MEDICAL BU., English, *Sci. Am. Sup.* May 15-6.
" MEMORIAL HALL, Lawrenceville School, N. J., *San. Eng.* Dec. 4-6; entrance, Mar. 5-7.
" METROPOLITAN CLUB, Washington, *San. Eng.* July 2-7; do. opera h. N. Y., Dec. 6-3.
" MITCHELL, J. G., res. Brookline, Mass., *San. Eng.* Apr. 1-6.
" MONT DORE, West Kirby, Cheshire, *Sci. Am. Sup.* Apr. 26-4.
" MONT ST. MICHEL, Normandy, *Sci. Am. Sup.* 29-4.
" MONTE CARLO CASINO, *Sci. Am. Sup.* June 6-5.
" MONUMENT NAT. (bu.) des., Rome, *Sci. Am. Sup.* Oct. 25-4.
" MOSQUE, great, court of, Damascus, *San. Eng.* Aug. 12-6.
" MURRAY HALL, Pablo Beach, Fla., *San. Eng.* Feb. 19-7.
" MUT. LIFE INS. BU., N. Y., *San. Eng.* May 22; Nov. 27-4.
" NEWCASTLE, N. H., h. on coast, *San. Eng.* June 17-6.
" NEWPORT, R. I., res. *San. Eng.* June 17; do. and St. Louis, Aug. 26-6.
" N. Y. COMMERCIAL BU., *San. Eng.* Apr. 23-7.
" NORTON, C. W., res. Alston, Mass., *San. Eng.* Aug. 6-7.
" NOTTINGHAM MECHANICS INST. *Sci. Am. Sup.* June 7-4.
" OCEANIC, N. J., res. *San. Eng.* Feb. 4-6.
" OSBORN, C. J., h. Mamaroneck, N. Y., *San. Eng.* Dec. 3-5.
" PALACE, Nancy, France, *San. Eng.* Jan. 15; at Agra, India, Feb. 12-5; of Trocadero, Paris, Nov. 6-6; of Exhib. of Fine Arts, Rome, *Sci. Am. Sup.* Mar. 24-3.
" PALAZZO, Vendramin-Caleigi, Venice, *Sci. Am. Sup.* Apr. 21-3.
" PANTHEON, Rome, *Sci. Am. Sup.* May 19-3.
" PARSONAGE, design, *Sci. Am. Sup.* June 16-3.
" PHILADELPHIA, *San. Eng.* Jan. 22, 29-7; Overbrook res. Jan. 7; suburban do. Apr. 15; h. at Wynnewood, Oct. 14-6.
" PICKARD, S. F., res. Portland, Me., *San. Eng.* Oct. 30-6.
" POST OFFICE, Brooklyn N. Y., *Sci. Am. Sup.* Sep. 19-5; Minneap., Minn., Jan. 19-4.

ARCHITECTURE, PULLMAN, Ill., casino and parsonage, *San. Eng.* July 16-4.
" PUMPING STATION, Boston sewerage, *Sci. Am. Sup.* Mar. 31-3.
" ROMANESQUE CAPITALS, *San. Eng.* Mar. 18-6.
" ROTTERDAM, h. of a thousand terrors, *Sci. Am. Sup.* Mar. 21-5.
" SALEM, Mass., pine apple h. *San. Eng.* Jan. 1-7.
" SAN ISIDRO, Bournemouth, *Sci. Am. Sup.* July 5-4.
" SANITORIUM, HOLLOWAY, Virginia Water, *Sci. Am. Sup.* Feb. 16-4.
" SCHEVENINGEN CASINO, *Sci. Am. Sup.* Aug. 22-5.
" SCHOOL, primary, Boston, *San. Eng.* May 6; do. O'Brien grammar, Oct. 14; Lawrenceville, N. J., Dec. 4-6; London, *Sci. Am. Sup.* Jan. 27; City of London, Victoria Emb., Feb. 9; Q. Elizabeth grammar, Heath, Apr. 14-3; technical high, Berlin and Strassburg University, Dec. 13-4.
" SHAKESPEARE MEMORIAL TOWER, Stratford, *Sci. Am. Sup.* Sep. 12-5.
" SEVEN OAKS, h. *Sci. Am. Sup.* May 26-3.
" SHEFFIELD offices and business block, *Sci. Am. Sup.* Apr. 25-5.
" SHOE FACTORY, Hanan & Sons, N. Y., *San. Eng.* Aug. 13-7.
" SHOOTING-BOX, Welsh, *San. Eng.* Dec. 25-6.
" SHORT HILLS, N. J., res. *San. Eng.* July 15; Nov. 13, 20-6.
" SKIDMORE, W. L., res. *San. Eng.* Nov. 26-5.
" SLOANE, W. D., res. Lenox, Mass., *Eng. & Bu. Rec.* Oct. 15-7.
" SOMERVILLE HALL, Oxford, *Sci. Am. Sup.* Mar. 17-3.
" SO. ORANGE, N. J., res. *San. Eng.* Dec. 4-6.
" SO. PARK, Chicago, res. *San. Eng.* Nov. 27-6.
" SOUTHPORT, Albany bu's, *Sci. Am. Sup.* Nov. 7-5.
" SPIRITUAL TEMPLE, porch, Boston, *San. Eng.* Mar. 25-6.
" STABLE, arrangements, Wetmore, *San. Eng.* Feb. 18; Marple Hall, England, Apr. 1-6; and store, Washington, May 7-7.
" STATIONS, Phil., Ger. and Chestnut Hill Ry., *San. Eng.* July 15-6; Boston & Albany R. and Conn. River R., Oct. 14-6; Feb. 12-7.
" ST. ALBANS ABBEY, *Sci. Am. Sup.* Aug. 22-5.

ARCHITECTURE, ST. GEORGE HILLS, h. *Sci. Am. Sup.* Jan. 16-**6**.
" ST. LOUIS res. *San. Eng.* Dec. 11-**6**.
" ST.PAULS, London, *Sci. Am. Sup.* Mar. 3-**3**; vicarage, July 26-**4**; do. July 25-**5**.
" STEPHENS COLLEGE, Annandale, N. Y., *San. Eng.* Mar. 11-**6**.
" STORE FRONT, *San. Eng.* Feb. 5-**7**.
" STRANG, res. Narragansett Pier, R. I., *San. Eug.* Dec. 18-**6**.
" TALLIAFERRO, W., res. Glenridge, N. J., *San. Eng.* Apr. 9-**7**.
" TAYLOR, H. A., res. Newport, R. I., *San. Eng.* May 14-**7**.
" TEMPLE OF DIANA, Ephesus, *Sci. Am. Sup.* Nov. 8-**4**; do. of Luxor, Egypt, Aug. 29-**5**; do. of Solomon, Feb. 20-**6**.
" THAYER, N., res. Boston, *San. Eng.* July 30-**4**.
" THEATRE, PALACE, Vienna, *Sci. Am. Sup.* Feb. 27-**6**.
" TIFFANY, C. L., res. N. Y., *San. Eng.* Apr. 9-**5**.
" TOWER, PINE, Branksome Park, *Sci. Am. Sup.* May 10-**4**.
" TOWN HALL, Westminster, *Sci. Am. Sup.* Sep. 15-**3**.
" TRASK, S., res. Saratoga Springs, *San. Eng.* Dec. 11-**6**.
" TY-TO-MAEN, St. Mellons, Cardiff, *Sci. Am. Sup.* Jan. 2-**6**.
" UNDERWOOD, H., res. Belmont, Mass., *San. Eng.* Feb. 12-**7**.
" UNION THEOLOG. SEM., N. Y. City, *San. Eng.* Oct. 7-**6**.
" VANDERBILT WM. K., h. N. Y., *San. Eng.* Dec. 4; do. entrance Feb. 11-**6**; Cornelius, do. Dec. 11; stable, Apr. 17-**4**.
" VICTOR EMMANUEL MEMORIAL, des. Rome, *Sci. Am. Sup.* Mar. 17-**3**.
" VIENNA UNIVERSITY BU., *Sci. Am. Sup.* Jan. 10-**5**; City Hall park, Feb. 21-**5**.
" VILLARD, h. dining room fireplace, *San. Eng.* Jan. 29-**7**.
" VILLA DES. *Sci. Am. Sup.* June 9-**3**; villas, June 20-**5**; semi-detached, Leeds, Sep. 8-**3**.
" WASHINGTON, row of houses, *San. Eng.* Sep. 23-**6**; res. Oct. 1-**7**.
" WASTE WEIR OUTLET, Kangra tank, *San. Eng.* June 4-**7**.
" WATERLOW BU'S, London (for working people), *San. Eng.* Apr. 10-**4**.
" WATER TOWER, Swampscott, Mass., *San. Eng.* Nov. 13-**6**.
" WHITON, J. M., res. Plainfield, N. J., *San. Eng.* Apr. 23-**7**.
" WINCHESTER, Mass., res. *San. Eng.* Apr. 8-**6**.
" WINNIPEG, res. *Sci. Am. Sup.* Mar. 22-**4**.
" WOLFE, C., res. Newport, R. I., *San. Eng.* Mar. 26-**4**.
" WORKMEN'S DWELLINGS, Hornsey, *Sci. Am. Sup.* Jan. 19-**5**.
" Y. M. C. A., and res. Newburgh, N. Y., *San Eng.* July 16-**7**.
" YONKERS, N. Y., res. *San. Eng.* Apr. 30-**7**.

ARGENTINE REPUB., *Iron Age*, Feb. 19, Aug. 13-**5**; Aug. 12-**6**; Aug. 18-**7**; harbor imp. *Eng. News*, Nov. 21-**5**; other end of hemisphere, W. E. Curtis, *Harpers*, Nov.-**7**.

ARMIES AND NAVIES of Europe, table, *Eng. News*, May 30-**5**. See also MILITARY ENGINEERING.

ARMOR. See GUNNERY AND ARMOR.

ARROW RELEASE, Morse, *Sci. Am. Sup.* Jan. 29-**7**.

ASBESTOS, application of, *Iron Age*, May 20-**6**; *Sci. Am. Sup.* Aug. 4-**3**; *The Eng.* June 22-**3**; and opening machine, *Eng. News*, Mar. 6-**5**; do. Harefield wks., *Sci. Am. Sup.* Apr. 18-**5**.

ASPHALTE, rock, French, *Eng. News*, Apr. 18-**5**; origin and uses, *Sci. Am. Sup.* Aug. 4-**3**.

ASPHALTUM DEPOSITS of Cal., *Eng. News*, Jan. 8-**7**.

ASTRONOMICAL DAY, proposed abolition and effect on nav., S. J. Brown, *Van Nost.* Mar.-**6**.

" MOTIONS, *Fran. Inst.* files-**4**.

ASTRONOMY, aurora borealis, theories, *Sci. Am. Sup.* Feb. 17-**3**; comets, R. S. Ball, Nov. 8-**4**; do. tails of, Nov. 7-**5**; do. Bielas'; Newton, Mar. 20-**6**; do. of 1812, orbit of, Ritchie, *Soc. Arts*, Dec. 27-**3**; cosmosphere in teaching phenomena, F. H. Bailey, Oct. 27-**7**; Henry Draper memorial, *Fran. Inst.* July 7; eclipse of Algol, R. Hill, *Sci. Am. Sup.* Sep. 11-**6**; equatorial telescopes, Warner, Apr. 18-**5**; gaseous bodies, constitution of, Ritter, Dec. 27-**4**.

" LICK OBSERV. Eng. News, Sept. 12-**5**; do. glass for, *Mech.* Jan.-**5**; do. dome of, proportion, Fraser, *Sci. Am. Sup.* Feb. 21-**5**; Mars appearance in '86, July 10-**6**; meteors, McCarty, July 14-**3**; meteorites, Dewar, Feb. 20; do. do. origin, Mar. 6-**6**; do. of Cranbourne, Flight, *The Eng.* Aug. 17-**3**; do. Jan. 8-22-**6**.

" MOON, lunar surface and temp., Ericsson, *Van Nost.* Sep.-**6**; do. *Nature;* do. *Sci.Am.Sup.* Aug. 14-**6**; do. mass and theory of tides, D'Auria, *Fran. Inst.* Apr, May-**3**; do. temp., Ferrel, *The Eng.* May 7-**6**; Nice observ., floating dome, *Eng. News.* June 20-**5**; do. do. *Mech.* Sep.-**5**; do. Eiffel, *Eng.* June 12-**5**; do. *Sci. Am. Sup.* Dec. 27-**4**; do. Haynie, Nov. 21-**5**; notes, *Fran. Inst.* May-**3**; do. July, Oct.-**7**; observ., highest, in Europe, *Locom.* Aug.-**6**.

ASTRONOMY, LAWS of projectile motion in vacuo, Lodge, *The Eng.* Jan. 12-3; solar sys. *Sci.Am. Sup*, Nov. 13-6; stellar photography, Pickering, *Soc. Arts*, Dec. 23-6; watch trials at Kew observ., D. Glasgow *The Eng.* Jan. 1-6.

ATMOSPHERE, height limit, Mott, *Sci. Am. Sup.* Nov. 20-6; humidity, *Locom.*, Feb.-5; See also AIR.

ATMOSPHERIC TELEMETER SYSTEM, *Elec. World*, Mar. 7-5.

AUSTRALASIAN trade with U. S., *Iron Age*, May 20-6.

AUSTRALIA, colonies as a field for engineers, *Eng.* Jan. 25-4; Am. locoms. in, *Ry. Gaz.*, July 13-3; pearl shell, *Iron Age*, Oct. 29-5; prog. June 2-7; U. S. trade with, Jan. 27-7; western, map, *Eng.* Jan. 21-7.

BALLOONING, military, *Eng. News*, July 14-3; do. *Eng.* June 22-3; do. *Sci. Am. Sup.* Aug. 11-3; do. navigable war, July 18-5; do. evolutions in France, Nov. 6-6; expts., Brearey, Jan. 22-7.

BALLOONS, kite, captive, Archibald, *Ry. & Eng.* Sep.-7; navigable trains of air-ships, *Elec. Rev.* Feb. 28-5; do. *Sci. Am*; Woelfert's, *Sci. Am. Sup.* Sep. 1; manuf. at Paris, Dec. 1; Tissandier's elec. Dec. 22-3; centenary of, Mar. 15; captive, Turin, Aug. 16; Renard's elec. Oct. 4, 18; do. and Kreb's, Nov. 29-4; Capazza's lenticular, May 30; Blanchard centenary, Aug. 1-5; Chalais, Renard, Mar. 13-6; metal, *The Eng.* Feb. 9-3; ærial nav., n. Pole, Sep. 11-5.

BALTIMORE, flour export, growth, *Ry. Gaz.* Nov. 19-6.

BARB FENCE PATENTS, overthrow, *Elec. Rev.* June 28-3; *Sci. Am.*

BAROMETERS, Goldschmid, *Eng. News*, Apr. 3-6; recording, *Mech.* Apr.-5; aneroid, *Elec. Rev.* July 5-4; Dufour's registering, *Sci. Am. Sup.* Jan. 19-4. See also METEOROLOGICAL INSTRUMENTS.

BARREL MACH., French, *Sci. Am. Sup.* Aug. 2-4; bbls., paper, manuf., Deering, Dec. 4-6.

BARTHOLDI, AUGUSTE FREDERIC, por. *Sci. Am. Sup.* Dec. 18-6.

BASE-BALL-ISTICS, n. Michaelis, *Fran. Inst.* Mar.-7; base ball science, *Sci. Am. Sup.* Sep. 15; do. Rutherford, Nov. 10-3; do. Hiscox, Feb. 9-4.

BEAMS AND GIRDERS, wts. of girders and roofs, Buck, *Eng. News*, Mar. 3; beams, I and channel bars, comparative moment of inertia, Bland, Mar. 17-3; plates, stresses on rivets in, Mar. 6-6; truss deflection, June 18-7.

BEAMS AND GIRDERS, iron and steel, *Iron Age*, July 26; English practice, Nov. 29-3; curious wooden, Apr. 23; Coffin's diagrams for Phœnix beams, Aug. 20-5; do. *Mech.* Sep.-5; English practice, Pendred, Dec. 8-3; cost of manuf. I beams in Belgium, *Iron Age*, Aug. 26-6; steel and iron riveted, expts., Strobel, *Am. Eng.* Mar. 7-21; tests of iron girders and columns, U. S. testing board rep. Dec. 5; transverse strength wooden beams, Hartford, Dec. 12-4; wrt. iron and struts, strength, *Ry. Gaz.* Oct. 12-3; secondary strains on statical structures, Mar. 28; tests, Harkort, May 2, July 25, Sep. 12-4.

" STRESSES IN, Wood, *Van Nost.* Jan; strains in, bow girders, Werner, Oct.-4; proportion between stresses and sections in girder wk., Feb.-5; do. *The Eng;* strength of steel and wrt. iron, Anderson, Oct; formulas, Philbrick, Oct, Nov.-6; application of virtual velocities to deflection and stresses of frames, *Fran. Inst.* Feb, Apr.-3; diagrams for calculating stresses in bowstring girders, Lean, *Sci. Am. Sup.* Apr. 4-5; Kennedy, Apr. 30-7; size of rolled I beams for different loads and spans, table, *Locom.* Dec.-4.

" LOADS ON, *Eng.* June 6-4; stresses on girder bracing, Elliott, July 1-7; rolled iron joists, strength, Lixon, *The Eng.* Mar. 23; resistance of beams when strained beyond elastic limit, W. R. Browne, Sept. 28; b. and g. cals., Ende, Nov. 9, Dec. 7, 21-3; continuous, cals. do. Feb. 22, do., MacKensie, Sep. 5; theory of arched girders, Totth, June 13; cals. of girder stresses, Lean, Dec. 26-4; do. do. Feb. 20; deflection formulas of beams, Donaldson, July 3-5; strength, Unwin, Oct. 29-6.

BEARINGS, ball thrust, *Iron Age*, Sep. 2-6.

BEAVER FALLS INDUSTRIES, *Iron Age*, Mar. 27-4.

BEER, consumption stats. *Sci. Am. Sup.* Apr. 7-3; testing ap. Aug. 20-7.

BELLS, largest, Nystrom, *Iron Age*, Mar. 29-3.

BENHAM, HENRY W., *Eng. News*, June 7-4.

BELTING, flour mill, *Iron Age*, July 16-5; transmiss. of power by, Shay, Nov. 17-7; do. *Elec. Rev.* Feb. 19-7; do. Atta, *Mech.* Sep.-4; friction of leather on iron pulleys, Holman, Oct.-5; Mar.-6 etc.; driving power of pulleys, Feb, Mar, May.-7; tests, Webber, *Mech. sup.* June-7.

BELTING, BELTS, length of, T. Square, *Am. Eng.* Apr. 8, 15; factory, June 30; leather, Aug. 25-**6**; transmiss. of power by, Sawyer, *Van Nost.* Sep.-**3**; do. by belts, cords and wire, Leloutre, July-**4**; oil dressed, *Fran. Inst.* Oct.-**3**; leather, friction on iron pulleys, Sep.-**5**; leather link, Schieren, *Elec. Rev.* June 25; do. do. *Sci. Am. Sup.* July 9-**7**; do. Ireson, (for elec. purposes), *Elec. Rev.* Oct.22-**7**; do. *Elec. World*, Oct. 22-**7**; Tullis, *Sci. Am. Sup.* Aug. 15-**5**; do. *Eng.* June 26-**5**; transmiss. of power by, mech. eng. lab. Mass. Inst. Tech., Lanza, *Soc. Arts*, Jan. 28-**6**; and ropes for driving, Tullis, *The Eng.* June 26; and rope gearing, vel. in, Nov. 13-**5**.

BEVERAGES, gaseous, Boulet's measuring ap. *Sci. Am. Sup.* Nov. 7-**5**; carbonated, domestic manuf. of, C. E. Avery, *Soc. Arts*, Nov. 11-**6**.

BEVELING MACHINE, Davis, Scotland, *Mech.* Dec.-**5**.

BICYCLES AND TRICYCLES, *Mech.* June 9-**3**; Boys, *Van Nost.* Aug.-**4**; do. *Sci. Am. Sup.* July 26-**4**; velocipede, hist., Jan. 29; Taylor, July 23-**7**; power used by bicycle, *The Eng.* Apr. 13-**3**; bicycle wks., Coventry, England, Sep. 10-**6**.

BILLS OF LADING, conditions in, *Iron Age*, May 13-**6**.

BINARY VAPOR ENGINES, *Sci. Am. Sup.* Feb. 14-**5**.

BIRMINGHAM, Ala., *Iron Age*, Apr. 15-**6**.

BLEACHING MACHINE, *Sci. Am. Sup.* Nov. 28-**5**; bleaching and scouring processes, Feb. 12-**7**. See also CHEMISTRY, BLEACHING.

BLOWERS AND FANS, ventil. effect of, *Eng. News*, Dec. 11-**6**; fan, *Mech.* Mar. 24-**3**; expts., Snell, Dec.-**7**; do. *Am. Eng.* Dec. 21-**7**; Snell, Nov. 23, 30-**7**; Smith ventilator fan, Sep. 3-**5**; fan, *Sci. Am. Sup.* Apr. 14-**3**; Stewart's rotary, and exhauster, *Eng.* July 27-**3**; Thwaite's rotary, Apr. 16-**6**; effic. of, Snell, Dec. 30-**7**; fan, Capel, *The Eng.* Feb. 16; Stewart's differential, Sep. 21; fans, effic. Nov. 16, n. Dec. 7, 7-**3**; do. Jan, 4, 18, Feb. 1; Guibal fan, Feb. 8; Capel tests rep., D. K. Clark, Mar. 28; fans, effic. of, Herschell, Nov. 14, Dec. 26-**4**; do. do. Fraser, May 22; do. Jan. 2-**5**; fan testing, R. H. Smith, July 24-**5**; Root's, Feb. 12, Apr. 26-**6**.

BLOWING ENGINES, Wermer's, *Am. Eng.* Feb. 15-29, Mar. 7-**4**; Galloway, *The Eng.* May 11, 18-**3**; horizontal, Nov. 14-**4**; for charcoal fires, Jan. 2-**5**; Meuse, Jan. 8-**6**; Sep. 9-**7**.

BOLT AND ROD TURNING MACHINE, Nicholson, *Iron Age*, Nov. 10-**7**.

BOLTS AND NUTS, standard sizes, *Iron Age*, Nov. 6-**4**; do. *Fran. Inst.* Dec. **4**; Fran. Inst. standard, Mar.-**5**; M. C. B. Club, *Ry. Gaz.* Jan. 5-**3**; Seller's standard, table, *Sci. Am. Sup.* June 28-**4**; spring washers, Grover, *Eng.* Feb. 25-**7**; nut finishing machine, Manchester exhib. *The Eng.* July 8.-**7**; screw threads, expts., King, *Eng. News*, Oct. 17-**5**; do. *Iron Age*, July 9-**5**; do. *Mech.* July-**5**; strength of bolts as affected by thread, *Am. Eng.* June 3-**6**; Seller's standard sys. of screw threads, table, *Ry. Gaz.* May 30-**4**. See also SCREW THREADS.

BOOK MAKING MACHINE, Feister, *Eng. News*, Apr. 10-**6**; do. perfecting do. *Eng.* Mar. 4-**7**.

" NOTICES, *Fran. Inst.* files, Jan.-**3**–Dec.-**7**.

BORING MACHINE, Gulland's, *The Eng.* Aug. 21-**5**; and screw cutting ap., Snowden, *Eng.* May 22-**5**.

BOSTON, making new land in, *Eng. News*, Feb. 20; streets and st. rys. Mar. 13-**6**; pass. travel growth, Galloupe, Aug. 6; park sys. Aug. 27; West End imp. Oct. 22-**7**; pass. travel, n. *Ry. Gaz.* Jan. 16-**5**; do. Nov. 19, Dec. 24; Revere Beach travel, Nov. 5-**6**.

BOTTLE TESTING MACHINE, Salleron, *Sci. Am. Sup.* Oct. 1-**7**.

BOURDON, EUGENE, por. *Sci. Am. Sup.* Nov. 29-**4**.

BOX NAILING MACHINE, cyl. *Sci. Am. Sup.* Apr. 17-**6**; do. Lines', *The Eng.* Aug. 14-**5**.

BRAKE, friction, Beer, Belgium, *Iron Age*, June 5-**4**; prony, large, Apr. 29-**6**; do. *Fran. Inst.* Apr.-**6**; hydr. gov. Ulmann's, *Sci. Am. Sup.* Sep. 24-**7**. See also RAILROAD BRAKE.

BRAZIL, U. S. trade with, *Iron Age*, July 23-**5**; do. Mar. 17-**7**; developments in, Apr. 15-**6**; Aug. 4, Dec. 29-**7**; physical geog. *Eng.* Aug. 13-6,

BREWERIES, dust explosions in, *Fran. Inst.* Feb.-**3**; Swan br'y. England, *The Eng.* June 29, July 6, 13; Well Park br'y. Exeter, England, Sep. 21-**3**; 160-quarters, at York. Jan 11-**4**.

BREWERS EXHIB., *Eng.* Oct. 26-**3**; Nov.-**5**.

BREWING AP., Cone's, *Sci. Am. Sup.* Jan. 6-**3**; hops, bitter substance of, J. Bungener, July 26; steam plant, Girard's, France, Aug. 9-**4**.

BRICK, indus. N. Y. city, Tomkin's, *Eng. News*, June 11-7; wk., crushing strength of, *Iron Age*, Nov. 26-5; making machs., English, Johnson, *Mech.* July-4; do. *Eng.* June 20-4; do. *The Eng.* May 29-5; making, Ward, *Am. Eng.* May 20-6; machs. *Fran. Inst.* Jan.-3; wk., Woodley, *Sci. Am. Sup.* Aug. 11-3; brick, lime and cement kiln, Hoffman, Dec. 18-6; bricks and brickwk., T. R. Smith, July 9-7; pressing and perforating mach., Page's hand-power, *The Eng.* Aug. 3-3; making, H. Ward, Apr. 30-6.

BRIDGES, ABERGAVENNY, sewerage wks., foot, *The Eng.* Feb. 20-5.

" ABERGELDIE suspen. *The Eng.* Aug. 7-5.

" ABUTMENT STRENGTHENING, Chestnut st., Phil., *The Eng.* Feb. 6-5; *Sci. Am.*

" ACCIDENT, fall during construction, Balt. & O. R., *Eng.* Mar. 6-5.

" ADIGE R., at Verona, *Sci. Am. Sup.* June 6-5; do. Biadego, *Eng.* Apr. 17-5.

" ALBERT, *The Eng.* Dec. 4-5.

" ALBULA, Solis, Switz., *Sci. Am. Sup.* June 16-3.

" ALLEGHENY SUSPEN. Pittsburg Junct. R., rep. on cables, Collingwood, *Eng. News*, Aug. 2-4; *Van Nost.* Apr.-5; *Ry. Gaz.* Apr. 3-5; *Eng.* July 11-4; *The Eng.* Aug. 15-4.

" AM. DESIGNS, Graham, *The Eng.* Mar. 5; iron, Mar. 26; May 28-6.

" ANGLESEA SWING, Cork, *Sci. Am. Sup.* July 19-4; *Eng.* Nov. 23, Dec. 7, 21-3; hydr. mach. Feb. 20-5.

" APPOMATTOX HIGH, *Eng. News*, Oct. 22-7.

" ARCHES, false skew, *Eng. News*, Mar. 20; stone, Penn. R., Aug. 13-7; arch abuts., thickness, Trautwine's rule for, *Ry. Gaz.* Apr. 17-5; beton, fall of, Greece, June 25-6; masonry, on Penn. R., July 8-7.

" ARTHUR KILL, *San Eng.* Jan. 15-7.

" ATTOCK, cantilever, over Indus r., Punjaub, staging for, *Eng. News*, Jan. 10-5; *Sci. Am. Sup.* Jan. 3-5; *Eng.* Nov. 14. 28, Dec. 12, 26-4.

" BAGAIN R., Indian Midland Ry., Berkley, *Eng.* May. 27, June 10-7.

" BATTERSEA, *The Eng.* July 16, 23-6.

" BEDFORD, over Ouse r., *The Eng.* Dec. 5-4.

" BERLIN City Ry., iron, *The Eng.* May 4-3.

BRIDGES, BIG OTTER CREEK, wrecked, Norfolk & West. R., *Ry. Gaz.* Apr. 8-**7**.

" BISMARCK, Missouri r. N. Pac. R., *Ry. Gaz.* Dec. 7, 14-**3**; *Sci. Am. Sup.* Jan. 5-**4**; and derrick boat for, *Eng.* Jan. 11, 25; Morrison, Feb. 8-**4**.

" BLACKFRIARS, over Thames r., Lond., Chat. & Dover Ry., *The Eng.* Apr. 27-**3**; Aug. 29, Sep. 12-**4**.

" BLAIR CROSSING, Missouri r., Neb., *Eng. News*, Nov. 17-**3**; *Ry. Gaz.* Nov. 9, 30-**3**; *Sci. Am. Sup.* Dec. 22-**3**; Nov. 12-**7**; Morrison, *Eng.* Sep. 2, 30-**7**.

" BLAAUW KRANTZ VIADUCT, Cape Colony, *Am. Eng.* Jan. 23, May 15-**5**; *Sci. Am. Sup.* Apr. 11-**5**; Ende, eng., *The Eng.* Feb. 27, Mar. 13, Apr. 17-**5**.

" BORDE'S HOISTING AP., viaduct construction by, *Sci. Am. Sup.* Dec. 4-**6**.

" BRENT VIADUCT, Hounslow & Met. Ry., London, *Sci. Am. Sup.* Nov. 3-**3**; *The Eng.* Sep. 7, 7-**3**.

" BROKEN, Balt. & O. R., *The Eng.* July 15-**7**.

" BROOKLYN SUSPEN., and N. Y., (East r.), R. Hering, *Eng. News*, Jan. 13; Adams, Jan. 20; May 26, June 2; accident, June 9; hist. June 16-**3**; Mar. 29-**4**; travel charts, Jan. 31-**5**; rep., '85, Jan. 16, Nov. 13-**6**; June 4, 18; problem, June 11; imp., June 25; Nov. 5-**7**; *Iron Age*, May 3, 31-**3**; *Ry. Gaz.* June 1-**3**; grip, Dec. 25-**5**; Chatham st. extension, May 13-**7**; *St. Ry. Gaz.* June-**6**; *Elec. Rev.* Apr. 12-**3**; *Sci. Am. Sup.* May 26, July 14-**3**; *Locom.* Aug.-**3**; *Eng.* May 25-**3**; *The Eng.* June 1-**3**.

" BUILDING, in U. S., *Iron Age*, Mar. 4-**6**; econ., *Ry. Gaz.* Dec. 10-**6**; Apr. 29-**7**; do. Ottewell, Mar. 25-**7**.

" BUYING, *Ry. Gaz.* Sep. 17, Oct. 1, 15-**6**.

" BUZZEY, (Tin; Forest Hills; Roslindale), accident, Bost. & Prov. R., *Eng. News*, Mar. 19, 26, Apr. 2-**7**; disaster, rep. on, May 4, M. A. Howe, *Am. Eng.* Apr. 6; Meatyard, Apr. 20-**7**; *The Eng.* Apr. 1-**7**. See also BRIDGE, SOUTH ST. ARCH.

" CABIN JOHN ARCH, Washington, Meigs, *Eng. News*, June 25-**7**.

" CANTILEVER, *Eng. News*, Dec. 15; first, Dec. 29-**3**; Jan. 5, 19; n. Fanning, July 12-**4**; oriental, Japan, *Van Nost.* Jan.-**6**. See also names of bridges.

BRIDGES, CARE OF, T. Cooper, *Sci. Am. Sup.* June 2-3.
" CENTRAL VIADUCT, foundations, Cleveland rep., Searles, *Ry. & Eng.* Sep.-7.
" CICERO, Ill., *Am. Eng.* Mar. 7, 14-4.
" CLAREMONT, Iowa, 3-hinged iron arch, Cunningham, *The Eng.* Aug. 12-7.
" CLOONACANNA, over Moy r., Elwes, eng., *The Eng.* June 6-4.
" COBDEN FREE, Southampton, *Eng.* Jan. 4-4.
" COLEMAN, Singapore, *The Eng.* Feb. 22-4.
" COLOGNE, over Rhine r., Ry. and road, *Sci. Am. Sup.* Oct. 4-4; *The Eng.* Aug. 22-4.
" COLUMNS, pin-ended, tests, T. Cooper, *Eng. News*, Feb. 3-3; U. S. gov. tests, *Van Nost.* Aug.-3.
" COMPARATIVE WTS. OF Pegram, *Ry. Gaz.* Sep. 17-6.
" CONESTOGA, Penn. R., *Eng. News*, Oct. 22-7.
" CONSTRUCTION, *Am. Eng.* Sep. 5-4; hist. of development of, W. P. Trowbridge, *Eng. & Bu. Rec.* Oct. 15-7.
" CRAWFORD, Singapore, *The Eng.* June 22-3.
" CULVERTS, East. & Midland Ry. Marriott, *Eng.* Jan. 14-7.
" DANUBE R., des. *Am. Eng.* Feb. 22-4; proposed, Graham, *The Eng*, Nov. 7, 28; Dec. 26, 26-4; do. Jan. 30, 30, July 17-5.
" DEFLECTION MEASURING AP., *Sci. Am. Sup.* May 7-7.
" DESIGNS, n. Wernnag, *Eng. News*, Aug. 15-5; a bad, Mar. 26-7; *Ry. Gaz.* Apr. 30-6.
" Detroit R., *Eng. News*, Mar. 5-7.
" DIMENSIONING, new meth., Ottewell, *Eng. News*, May 14. 21, Sep. 19-7; n. on Weyrauch's meth. of det. Cain, *Van Nost.* Feb.-4.
" DNIEPER R., Russia, *Sci. Am. Eng.* June 26-6; *Eng.* Jan. 16-30, Feb. 13, 27-5.
" DONARNENEZ VIADUCT, France, fall of, *Sci. Am. Sup.* Feb. 9-3; raising fallen girder, Dec. 13-4.
" DRAW-SPAN, McCabe, *Am. Eng.* Jan. 21, Feb. 25, Mar. 4, 18, 25, Apr. 15-6; Ry. draw, Milwaukee, *Eng. & Bu. Rec.* Nov. 26-7; do. double track, Staten Is. Rap. Transit Co., Boller, *Ry. Gaz.* Nov. 19-6; do. one-armed, do. *Eng.* Feb. 11-7; Newark Bay, Cen. R. of N. J., *Ry. Gaz.* June 17-7; strains, formula, Beresford, *Van Nost.* Feb.-5; Crimea st., Paris, *Sci. Am. Sup.* Feb. 6-6; over Harlem r., Suburb. Rap. Transit Co., May 14-7; Harlem r., N. Y. Elevated Ry., Cooper, *Eng.* Apr. 1-7.

BRIDGES, EAST R., N. Y. See BRIDGES, BROOKLYN.

" EAST. & MIDLAND Ry., and station yards, Marriott, *Eng.* Jan. 21-**7**.

" ECHAIG, Bell, eng., *The Eng.* Sep. 18-**5**.

" ENGLISH, some poor, *Eng. News*, June 18-**7**.

" ERECTION, false wks. *Eng. News*, Mar. 24-**3**.

" EYEBARS, steel, Breithaupt, *Am. Eng.* Oct. 13-**6**.

" FAILURES, '86, *Eng. News*, Apr. 30-**7**.

" FEEDER R., Great West. Ry., *The Eng.* Feb. 8-**4**.

" FLOOR BEAMS, unsafe, *Eng. News*, June 25, July 9, 23-**7**; wrt. iron, double track, test, Boller, *Eng. & Bu. Rec.* Dec. 10-**7**.

" FLOORS, standard, White, *Ry. Gaz.* June 6-**4**; and warehouse, Sep. 9-**7**.

" FOOT, at La Villette, *Sci. Am. Sup.* Apr. 21-**3**; do. *Eng.* Mar. 9-**3**; failure, Chatham, Aug. 28-**5**; Abergavenny, *The Eng.* Feb. 20-**5**.

" FORMULA, for fixed wt. of, Painter, *Am. Eng.* Dec. 24-**5**.

" FORTH, RY. AND WORKS, *Eng. News*, Nov. 24, Dec. 29-**3**; July 12, Sep. 20, Nov. 1, 8-**4**; Biggart, Feb. 28, Mar. 21, Apr. 11; Hutchinson rep., Oct. 10, 31, Nov. 28-**5**; Aug. 28-**6**; *Iron Age*, Apr. 2, July 2, Oct. 8; hydr. ap., Oct. 29-**5**; mach., Sep. 1-**7**; *Mech.* May-**5**; n. *Am. Eng.* Feb. 8, July 18; B. Baker, Oct. 10–31, Nov. 7-**4**; July 3-**5**; June 24; Nov. 24-**6**; Mar. 23, May 18, Aug. 17, Sep. 7-**7**; tube riveting machs., Moir, *Eng. & Bu. Rec.* Oct. 22, Dec. 3-**7**; *Ry. Gaz.* July 27-**3**; July 11, Oct. 17–31-**4**; Apr. 30, Nov. 26, Dec. 17-**6**; Mar. 11-**7**; Airy and Baker, *Van Nost.* Jan.-**3**; n. Mar.-**4**; Oct. Dec.-**5**; n. Dec.-**6**; B. Baker, *Sci. Am. Sup.* Oct. 14-**4**; Biggart, Feb. 28; Baker, Aug. 22; T. C. Clarke, Oct. 10; Baker, Oct. 24; Biggart, Nov. 14; Dec. 12-**5**; Apr. 23, 30, Dec. 31-**7**.

" FORTH, etc., *Eng.* Aug. 17-**3**; Jan. 18, Aug. 29, Sep. 5-**4**; Jan. 9, 16, Feb. 6, 20, Mar. 13, Sep. 11, 18, 18, Oct. 9, 16, 30, Nov. 27, 27, Dec. 4-**5**; July 16, Oct. 22-**6**; Fowler and Baker, Mar. 4, 18, Apr. 15, June 3, July 29, Aug. 5–26, Sep. 9-**7**; B. Baker, *The Eng.* Nov. 7, 21, Dec. 5-**4**; mach., Jan. 16, Feb. 6, 13, 27, July 24, 24; Baker, Sep. 11, Oct. 9, 16, 16-**5**; triangulation and measurement of, Middleton, Oct. 8–29, Nov. 12, Dec. 3, 10-**6**; do. *Eng. News*, Nov. 13, 20-**6**; *The Eng.* Feb. 4, 11, Mar. 11, July 22; Biggart, Nov. 25, 25-**7**.

BRIDGES, FRAZER R., Can. Pac. Ry., *Eng.* Sep. **5-4**.

" FRENCH ARTICULATED, *Ry. Gaz.* Apr. **15-7**.

" GARABIT VIADUCT, France, *Eng. News*, Aug. 9, **30-4**; Eiffel, *Mech.* July-**5**; *Sci. Am. Sup.* June **30-3**; *Eng.* May 15, **29-5**.

" GEORGETOWN VIADUCT, U. Pac. R., *Sci. Am. Sup.* Sep.**25-6**.

" GERMAN, construction regulations, *The Eng.* July **25-4**.

" GIRDER, plate, Becker, *Eng. News*, Jan. 17; do. Doran, Feb. **28-5**; des. Oct. **30-6**; continuous, graph. meth. of representing strains in, McCabe, *Am. Eng.* Dec. **10-5**; iron and steel, expts. *Ry. Gaz.* Jan. **26-3**; Dutch gov. tests, Strobel Mar. **21-4**; diagonals, Austrian Rys., July **17-5**; do. *The Eng. sup.* May **22-5**; wt. of, Shelford, *Ry. Gaz.* Dec. **3-6**; bowstring, stresses in, *The Eng.* Feb. 20; girders, Beypore, Madras Ry. June **19-5**; des. Shelford, Sep. **10-6**.

" GRAND CANON, Pueblo & Ark. Val. R., *Am. Eng.* May 16, **23-4**.

" GUARD RAILS, Mass. R. Commissioners circular, *Eng. News*, Dec. 31-7; *Ry. Gaz.* Dec. 30, **30-7**.

" HANGLETON, Brighton & Dyke Ry., *The Eng.* Sep. **16-7**.

' HAVRE DE GRACE, Balt. & O. R., Md., *Eng. News*, May 10; caisson air-lock, Nov. 22; accident to, E. L. Abbott, Nov. **29-4**; Jan. 3; caissons, &c., Patton, Feb. 7; do. sinking, do. Apr. 11-25, May **2-5**.

" HAMMERSMITH, *The Eng.* Apr. 22, 29, May **20-7**.

" HARLEM R., proposed, *Eng. News*, Feb. 20, 27, Apr. 10; draw, Suburb. Rap. Trans. Co., spec., Cooper, July 17-31, Sep. **18-6**; Manhattan, caisson, May 28, June **11-7**.

" HARRISON, overhead, Tor., Grey & Bruce R., *Eng. News*, May **15-6**.

" HAWKESBURY R., New So. Wales, Aus., *Eng. News*, Feb. 13; designs for, May 8; June **5-6**; *Ry. Gaz.* Apr. 30; foundations, June **18-6**; designs for, *Eng.* Apr. **16-6**; Feb. 25, Mar. 11; foundation caissons, Fowler, Apr. 8, **22-7**; *The Eng.* Nov. **14-4**; borings, Feb. **20-5**.

" HENDERSON, Ky., *Ry. Gaz.* Aug. **14-5**.

" HIGH, construction, *Eng. News*, Aug. **14-6**; Nor. & West. R., *Iron Age*, Aug. **5-6**; do. *Ry. Gaz.* July **23-6**. See also names of bridges, Kinzua, etc.

BRIDGES, HIGHWAY, iron, specs., Waddell, *Am. Eng.* Aug. 8, 15-**4**; Jan. 12; Meatyard, Feb. 2-**7**; standard, N. Y., New Haven & Hart. R., *Ry. Gaz.* Oct. 28-**7**; des. *Eng.* July 31-**5**.

" HOOGHLY R., cantilever, East Indian Ry., *Ry. & Eng.* Mar.-**7**; *The Eng.* Jan. 23, Feb. 13, 20, Mar. 20-**5**.

" HOWE TRUSS, cost of labor in framing and erecting, *Eng. News*, Mar. 24-**3**; brace and equation of 4th degree, Crehore, *Van Nost.* Jan.-**4**.

" IBICUY R., Grt. Southern Ry., Brazil, Rumball, *Eng.* Feb. 4-**7**.

" INDIAN STATE RYS., 100-ft. span, *The Eng.* Feb. 8-**4**; Sep. 25-**5**.

" INDICATOR, Biadego, Robinson, *Mech.* Feb. 2-**4**.

" INDUS RY., *Sci. Am. Sup.* Apr. 21-**3**.

" INSPECTION, N.Y. State, *Eng. News*, Apr. 30-**7**; and strength of materials, Howard, *Iron Age*, May 19-**7**; of public wks., Vose, *Van Nost.* Sep.-**3**; *Fran. Inst.* Mar.-**3**.

" IRON, care and maintenance of, Blunden, *Eng. News*, Apr, 7, 14-**3**; inventor of, Thomas Paine, *Iron Age*, Sep. 30-**6**: in Central Europe, July 21-**7**; in U. S., hist. *Am. Eng.* Dec. 28-**7**; care of, *Ry. Gaz.* Mar. 23-**3**; preserv., Paschen, *Van Nost.* Nov; German, construction regs., Nov.-**4**; do. *The Eng.* arched, hinge joint construction for, Backhaus, *The Eng.* Dec. 31-**6**.

" KENNET R., Reading, England, *Sci. Am. Sup.* July 25-**5**; *The Eng.* May 29-**5**.

" KIRCHENFELD, Berne, *Sci. Am. Sup.* Dec. 8-**3**.

" KINIPPLES, travelling and folding, Greenock, *Eng.* July 27, Aug. 17-**3**.

" KINZUA VIADUCT, highest in world, N. Y., L. Erie & West. R., *Sci. Am. Sup.* Jan. 27-**3**.

" KOSI R., Indian State Rys., *The Eng.* Nov. 19-**6**.

" LACHINE, *Eng. News*, Oct. 8, 10-**7**.

" LARGE, vs. steam ferries, Sedgwick, *Ry. & Eng.* May-**7**; wind pressure on, n. *Ry. Gaz.* Nov. 18-**7**.

" LA TARDES VIADUCT, Montbucon Ry., *The Eng.* Apr. 24, 24, May 1-**5**.

" LATTICES, stresses, Robertson, *The Eng.* Dec. 30-**7**.

BRIDGES, LAUTERMAN FALLS, O., *Am. Eng.* Jan. 2-5.
" LIFT, Oswego canal, Syracuse, N. Y., *Eng. News*, Sep. 27-4; over a canal, May 23-5; French, *Iron Age*, May 27-6.
" LIFTING, at Tarante, Italy, *Eng.* Oct. 14, 28, Nov. 11-7.
" LIVE LOADS FOR, *Ry. Gaz.* Dec. 10-6.
" LONESTOFT RAVINE, Parkinson, eng., *The Eng.* Sep. 2-7.
" LONG IS., proposed, *Eng. News*, Apr. 23-7.
" LONGEST IN WORLD, *Eng. News*, July 5-4.
" LOUISVILLE, movement in, Baker, *Eng. News*, Mar. 28-5; and New Albany, T. C. Clarke, Nov. 27-6.
" LOWELL, Mass., Central, *Am. Eng.* Sep. 26; over Merrimac r., Oct. 31-4.
" MADRID RY., *Sci. Am. Sup.* Nov. 3-3.
" MALMINOT VIADUCT, France, *Ry. Gaz.* July 24-5; *The Eng.* Mar. 20-5.
" MANNHEIM, des. *The Eng.* Dec. 16-7.
" MEMORIAL TO GRANT, Washington, proposed, Symons, *Eng. News*, Feb. 26-7.
" MEXICAN CONSTRUCTION, Flagg, *Sci. Am. Sup.* July 24-6.
" MIDLAND RY., wk., St. Pancras extension, *The Eng.* Dec. 25-5.
" MINNEAPOLIS, over Miss. r., spec., *Am. Eng.* Oct. 29-5.
" MINO R., internat., Spain & Portugal Ry., *Sci. Am. Sup.* July 25-5.
" MOBILE R., Mo. & Mont. R., Patton, *Eng. News*, Apr. 4-5.
" MONONGAHELA R., suspen., Pittsburgh, Lindenthal, *Eng. News*, July 7-3; May 2, 24, 31-4; Wickersham, May 26-3; do. *Iron Age*, June 21-3; do. *Mech.* June 9-3; do. *Sci. Am. Sup.* June 16-3; *Eng.* Mar. 14, Apr. 25-4.
" MT. CREEK, Can. Pac. R., W. A. Doane, *Eng. News*, Sep. 26-5.
" NATURAL, "Prebischthor," Saxony, *Sci. Am. Sup.* Sep. 27-4.
" N. Y. & BROOKLYN. See BRIDGES, BROOKLYN.
" NIAGARA FALLS, CANTILEVER, *Eng. News*, Dec. 29-3; traveler for, Mar. 1, May 17-4; towers replacement, Dec. 10-7; replacing stone with iron, *Eng. & Bu. Rec.* Nov. 5-7; towers, Buck, eng., *Ry. Gaz.* Nov. 4-7; Schneider des., Mar. 7-21-4; do. *Eng. News*, Oct. 6-3; do. *Van Nost.* Apr.-5; *Sci. Am. Sup.* Mar. 28-5; *Eng.* Mar. 5, 12, Apr. 2, 9-6; towers, Buck, eng., Dec. 9-7; do. *The Eng.* Dec. 9-7; Jan. 25-4.

BRIDGES, OMAHA, Neb., 16th st. viaduct, *Eng. News*, June 13-**5**; May 22-**6**.
" OPORTO, Luiz I, *Sci. Am. Sup.* Sep. 4, Oct. 9-**6**.
" LIFT, over Ourcq canal, *Sci. Am. Sup.* July 11-**5**.
" PHILA., *Eng. News*, Dec. 15-**3**; Market st., monument, Oct. 25-**4**; Oct. 16-**6**; Chestnut st., repairs to, Jan. 3; strengthening, Apr. 18-**5**; do. *Ry. Gaz.* Jan. 30-**5**; do. abutment strengthening, *The Eng.* Feb. 6-**5**; do. *Sci. Am.*; South st., *Fran. Inst*, June-**6**.
" PIERS, repairing, Kansas C., Pearsons, *Eng. News*, Dec. 25-**6**; river, foundations, Brendlinger, *Am. Eng.* Jan. 18, 25, Feb. 1-29-**4**; barrel, C. B. & Q. R., *Ry. Gaz.* Feb. 11-**7**; metallic, Albion, *The Eng.* Apr. 13, 20; Rangoon V. Ry., Aug. 3-**3**; wk., Burma State Rys., June 3-**7**.
" PITTSBURG AND ALLEGHENY SUSPEN., repairing, *Eng. News*, Nov. 17-**3**; rep., *The Eng.* Dec. 7-**3**.
" POINT, Pittsburg, *Sci. Am. Sup.* July 4-**5**.
" POINT PLEASANT, W. Va., coffer-dams, Patton, *Eng. News*, Mar. 14, May 30-**5**.
" PONTOON, railroad, Lawler, *Eng. News*, June 30-**3**; and pile, over Miss. r., at Prairie du Chien, Wis., Lawler, *Sci. Am. Sup.* Nov. 15-**4**; Ry., Guatemala, Jan. 31-**5**; Dec. 24-**7**.
" PORTABLE, Eiffel sys. *Eng. News*, Apr. 24-**6**; Ry., n. *Ry. & Eng.* Mar.-**7**; Cottran's sys. of, *Sci. Am. Sup.* Sep. 27, Dec. 6-**4**; do. *Eng.* Aug. 15-**4**.
" POUGHKEEPSIE, over Hudson r., *Eng. News*, Feb. 23-**4**; Oct. 15, 29-**7**; n. *Iron Age*, Feb. 22-**3**; O'Rourke, *San. Eng.* July 30-**7**; n. *Ry. Gaz.*, Sep. 10-**6**; July 1-**7**; *Sci. Am. Sup.* Mar. 5-**7**; n. *Eng.* Feb. 18, May 13, Aug. 26-**7**.
" PRINCES, Melbourne, Aus., *Sci. Am. Sup.* Mar. 13-**6**.
" RACCOON, Ind. & St. Louis R., wreck by wind, *Sci. Am. Sup.* Dec. 1-**3**.
" RAILROAD. See also under names of bridges.
" RAILROAD, oldest, whipple truss, Troy, N. Y., Del. & Hudson Canal Co., *Eng. News*, Apr. 7; viaducts in world, n. Oct. 27-**3**; do. *Iron Age*, Oct. 18-**3**; spec., Waddell, *Ry. Gaz.* Sep. 13, 20-**4**; cumulative vibrations in, June 26-**6**; trestles, E. A. Hill, Oct. 8-22; Louis. & Nash., Oct. 29; Erie, Nov. 5; truss, Pegram, Dec. 10, 17-**7**; long girder, Ky., *Iron Age*, Sep. 17-**5**.

BRIDGES, RAILROAD, removable, *Iron Age*, Aug. 12-**6**; N. Y. R. Commissioners, *Mech.* July-**5**; Furness, England, Light, *Am. Eng.* Dec. 31-**5**; specs., Apr. 27, May 4-**7**; vibrations, N. Y., Penn. and O., *Ry. Gaz.* June 25; heavy, and economical, Oct. 1; Old Columbia, Oct. 8-**6**; Am., *Sci. Am. Sup.* Apr. 2, 9-**7**; long span, Tomlinson, *Eng.* Aug. 13-**6**; inspection, Am. Soc. C. E., discuss. Aug. 19-**7**.

" RETIRO R., Brazil, Grunewald, *Sci. Am. Sup.* Mar. 25-**7**; *Eng.* Feb. 18-**7**.

" RIACHUELO R., Buenos Ayres, Port, E. Woods, *The Eng.* Oct. 8-**6**; Mar. 25-**7**.

" RIVETED VS. PIN CONNECTED, *Eng. News*, June 25-**7**.

" ROAD, double, Douro r., Oporto, *Eng.* July 2-**6**.

" ROKUGO R., foundations, Yokohama r., Japan, *Eng. News*, Feb. 16-**4**.

" RULO, Missouri r., Neb., C. B. & Q. R., spec. *Iron Age*, Sep. 16-**6**; *Ry. & Eng.* Sep.-**7**.

" SALTERHEBBLE VIADUCT, Hull Ry., England, piers, *Ry. Gaz.* June 13-**4**; *Sci. Am. Sup.* July 5-**4**; *The Eng.* Mar. 7-21-**4**.

" SAULT STE. MARIE, *Ry. Gaz.* July 15-**7**.

" SCHUYLKILL R., Balt. & O. R., *Eng. News*, Feb. 6; foundations, Mar. 27-**6**.

" SENECA R., Weedsport, N. Y., So. Cen. R., fall of, *Ry. Gaz.* Apr. 25-**4**.

" SIEE HO, China Rys., Kinder, *The Eng.* Dec. 2, 9-**7**.

" SIL R., *Sci. Am. Sup.* Nov. 3-**3**.

" SINGAPORE, Arab st., *The Eng.* Nov. 9-**3**.

" SOUTH ST. ARCH, (replacing Bussey br.) Bost. & Prov. R., *Ry. Gaz.* Dec. 30-**7**.

" SPEC. AND BUILDING, German, *Eng. News*, Aug. 6-**7**; standard, proposed, *Ry. Gaz.* Mar. 19; Dec. 10-**6**.

" SPEED REGISTERING ON, *Eng. News*, Mar. 15-**4**;

" ST. JOHN'S R., steel cantilever, N. B., *Eng. News*, Aug. 9-**4**; Aug. 15-**5**; *Ry. Gaz.* July 24, Oct. 30-**5**; *Eng.* Aug. 6, 27, Sep. 10, 24, Oct. 15-**6**.

" ST. LAWRENCE R., Lachine, Can. Pac. R., proposed, spec., *Eng. News*, Oct. 10-**5**; Shaler Smith, Oct. 1-**7**; *Mech.* June-**5**; *Ry. Gaz.* May 28, Nov. 26-**6**; Brunlees, *Eng.* Apr. 3-**5**; at Quebec, *Eng. News*, May 16-**5**; do. proposed, *Am. Eng.* May 1-**5**; do. *Eng.*

BRIDGES, ST. LEGER VALLEY, France, iron viaduct, *Sci. Am. Sup.* Mar. 24-**3**.

" STEEL WIRE FOR, n. *Van Nost.* Nov.-**6**.

" STRAINS, max. in, *Am. Eng.* Dec. 19-**4**; Jan. 9-**5**; max. positions of live load, single intersection trusses, Cain, *Van Nost.* Mar.-**5**; secondary, Bender, *Ry. Gaz.* Apr. 4, 11-**4**; effect of rail joints on, Jan. 28-**7**.

" STRATH TAIERI, New Zealand, Hay, *Eng. News*, July 12-**4**.

" STRESSES, in structures, graphic meth., Graham, *Am. Eng.* Jan. 4, 11-**4**; in frames, *Eng.* Dec. 7-**3**.

" STRINGERS, max. bending moment, Bland, *Eng. News*, Feb. 2-**4**.

" SUKKUR, over Indus r., India, *Eng. News*, Dec. 26-**5**; *Iron Age*, Oct. 22-**5**; *Ry. Gaz.* Dec. 18-**5**; n. *Van Nost.* Dec.-**5**; *The Eng.* Sep. 25-**5**; July 9, 30-**6**.

" SUTLEJ R., Empress, *Sci. Am. Sup.* Aug. 8-**5**; *The Eng.* Feb. 26-**6**.

" SUSPENSION, and triangular combined, Thacher, *Eng. News*, Nov. 10-**3**; early, Sep. 10-**7**; corroded wire cables, *Mech.* Nov. 24-**3**; Garson's, *Sci. Am. Sup.* Apr. 30-**7**; and cantilever, *The Eng.* July 11-**4**. See also under names, PITTS. & ALLEG., etc.

" SWING, Rush st., Chicago, *Eng. News*, Aug. 16-**4**; on N. Y. Cen. R., *Am. Eng.* Feb. 8; for Sing Sing, Feb. 15-**4**; Niederbaum dock, Hamburg, *Sci. Am. Sup.* Mar. 10-**3**; *Eng.* Jan. 19, Feb. 9, 16, Mar. 2-**3**; over Ouse r., Hull Ry., *Sci. Am. Sup.* Mar. 22-**4**; do. *The Eng.* Jan. 25, Apr. 4, 4-**4**; Denmark, Mar. 4-**7**.

" SWITZERLAND, in, *The Eng.* May 4-**3**.

" SYRACUSE, lifting at, N. Y. W. Shore & B. R., *Sci. Am. Sup.* Aug. 16-**4**.

" TAFF R., Glamorgan, *The Eng.* Oct. 19-**3**.

" TARDES VIADUCT, Montbucon Ry., France, wreck of, *Eng. News*, Sep. 20-**4**; *Sci. Am. Sup.* Oct. 11-**4**; *The Eng.* Apr. 24, 24, May 1-**5**.

" TAY VIADUCT, *Eng. News*, May 12-**3**; Mar. 1-**4**; Aug. 1; Oct. 31-**5**; opening, June 25, Aug. 6-**7**; *Mech.* Nov. 17-**3**; Barlow, eng., *Ry. Gaz.* Dec. 4-**5**; Sep. 2-**7**; Biggart, *Sci. Am. Sup.* Aug. 22, Oct. 31-**5**; do. Feb. 12, July 16; Kelsey, Dec. 3-**7**; do. *Eng.* Aug. 12-**7**.

BRIDGES, TAY VIADUCT, foundation appliances, *Eng.* June 26; Sep. 18-**5**; Dec. 31-**6**; Biggart, *The Eng.* July 10, Sep. 25-**5**; May 13; Kelsey, Sep. 2-**7**.

" TEKAPO, New Zealand, *Am Eng.* July 30-**5**.

" TEMPORARY, *Sci. Am. Sup.* Mar. 19-**7**.

" TENSAS R., M. & M. R., Patton, *Eng. News*, June 20-**5**.

" TESSIN R., Italy, Biadego, *Eng.* Sep. 18-**5**.

" TESTING MACHINE, 600-ton, Kellogg, *Eng. News*, Feb. 5-**7**.

" THAMES R., London, *Eng. News*, Aug. 21-**6**; and subway, proposed, *Sci. Am. Sup.* Mar. 8-**4**; at Tower, low level, proposed Kinipple *Sci. Am. Sup.* Mar. 28, June 20-**5**; do. July 31-**6**; do. *Eng.* Jan. 16-**5**; do. *The Eng.* May 8-**5**; *Eng.* Jan. 25, June; Putney, July 23-**6**; proposed, *The Eng.* Aug. 24-**3**; do. East of London, Jan. 25; at Little Tower Hill, Oct. 31-**4**.

" TONE R., Japan, Otagana, *Ry. & Eng.* Apr.-**7**.

" TORKHAM, India, *Eng. News*, Nov. 19-**7**.

" TOUNGOO RY., wk., *The Eng.* Dec. 3-**6**.

" TRAVELLING, *San. Eng.* Apr. 23-**7**.

" TRESTLES, wooden, Kan. C. &. Om. R. *Eng. News*, Aug. 13; railroad, wood cluster bent, Hanlon, Dec. 31-**7**; timber, Grand Rapids, Mich., Marson, *Am. Eng.* Feb. 29-**4**; deep water, Halifax harbor, Intercol., *Ry. Gaz.* Apr. 9-**6**.

" TRUSS, expired pats. on, Brock, *Eng. News*, Jan. 6–27, Feb. 17, 24, Mar. 10, 24, Apr. 28, May 12, 19, June 16, 23, July 7–28, Aug. 4–18, Sep. 1, 8-**3**; deflection of a, Sheridan, *Van Nost.* Dec.-**6**; depths and wts., formula, Du Bois, *Ry. & Eng.* June.-**7**.

" ULVERSTON CANAL, Furness Ry., England, C. J. Light, *Am. Eng.* Jan. 7-**6**.

" VIADUCT, Cape Col., Africa, Ende, *Eng. News*, Jan. 24-**5**; main, No. East. Ry., Cudworth, *The Eng.* Sep. 17-**6**. See also names of bridges.

" VIBRATIONS IN, S. W. Robinson, *Sci. Am. Sup.* Apr. 21, June 16-**3**.

" WALDLITOBEL VIADUCT, Arlberg Ry., *Eng. News*, Nov. 1-**4**; *Sci. Am. Sup.* Dec. 20-**4**.

" WAREHOUSE AND BRIDGE FLOORING, *Ry Gaz.* Sep. 9-**7**.

BRIDGES, WATERLOO, London, foundations, *Eng. News*, Mar. 31-**3**; restoration, *The Eng.* May 11-**5**.

" WEIGHTS, comparative, Pegram, *Ry. Gaz.* Sep. 17-**6**; and truss depths, formula for, Du Bois, *Ry. & Eng.* June-**7**.

" WESTPORT, Conn. *Eng. News*, Aug. 2-**4**.

" WHEN NOT A BRIDGE, *Eng. News*, May 22-**6**.

" WINOOSKI R., Vt., Barbour, *Eng. News*, Mar. 13-**6**

" WINSOR LOCKS SUSPEN., Conn., repairs of, *San. Eng.* Feb. 26-**7**.

" WORKS, Canadian, *Iron Age*, Feb. 12-**5**.

" YAZOO R., Tenn., Louis., N. Or. & Tex. Ry., *Eng. News*, Jan. 20, Sep. 8-**3**; *Sci. Am. Sup.* Nov. 10-**3**.

BRIDGING THE INDUS R., *Eng. News*, Jan. 20-**3**.

BRIGGS, ROBERT, *Mech.* Mar. 10-**3**.

BRITISH ASSOC., pro. *Am. Eng.* Sep. 5-26-**4**; Oct. 22, 29, Nov. 5-**5**; at Montreal, *Elec. World* Sep. 6, 13-**4**; do. *Sci. Am. Sup.* Sep. 27, Oct. 4-**4**; do. *The Eng.* Aug. 29-**4**; *Sci. Am. Sup.* Oct. 17; portraits membs., Oct. 31-**5**; Oct. 1-**7**; *Eng.* Sep. 28, Oct. 5, 12-**3**; Aug. 29, Sep. 19, Oct. 10, 24-**4**; Sep. 18, 25-**5**; Sep. 10-24, Oct. 1-**6**; Sep. 9-30, Oct. 7, 14-**7**; *The Eng.* Sep. 25, Oct. 2-**5**; Sept. 3, 10-**6**; Sep. 2-16-**7**.

" COLUMBIA, *Iron Age*, Aug. 25-**7**.

" COLONIAL AND INDIAN EXHIB., *Eng.* Feb. 12, Apr. 30, May 7; colonies, May 14; May 21, June 11, 18, July 16, Oct. 29-**6**.

" EMPIRE, size of, *Iron Age*, July 5-**3**.

" FOOD SUPPLY IN WAR, *The Eng.* July 27-**3**.

" GOV. MANUFS., *Eng.* July 23-**6**.

" GUIANA AND HONDURAS, U. S. trade with, *Iron Age*, June 17-**6**.

" NAVY ADDITIONS, *Iron Age*, Nov. 19-**5**; *Eng.* Jan. 16-**5**. See also MARINE, do.

" TRADE, Russian, *Iron Age*, Apr. 30-**5**; and Am. foreign, compared, Mar. 25-**6**; stats. of decline of, Jan. 28-**6**; do. *Ry. Gaz.* Aug. 12-**7**.

BRUSH, air, *Sci. Am. Sup.* Apr. 2-**7**.

BRUSH, CHAS. F., por., *Sci. Am. Sup.* Oct. 4-**4**.

BUENOS AYRES PUB. WORKS, *Eng. News*, Mar. 29-**4**.

BUFFALO LAKE TRAFFIC., N. Y., *Ry. Gaz.* Jan. 16-**5**.

BUILDING. See also ARCHITECTURE; ENGINEERING, BUILDING, MATERIALS; PLUMBING.

" AGRIC. HALL, Kensington, *Sci. Am. Sup.* June 5-**6**; do. *The Eng.* Apr. 30-**6**; Albert Exhib. Palace, May 23, June 6, 13, 13-**4**; Aquatic Circus, Paris, Edoux, eng., Mar. 19-**6**; do. *Sci. Am. Sup.* May 1-**6**.

" APART. H., Mad. ave., N. Y., *San. Eng.* June 14-**3**.

" BATH, Turkish and Russian, Hoffman h., N. Y. city, *San. Eng.* Feb. 21-**4**.

" BOSTON, Deer Is. hos., *San. Eng.* Nov. 13; Highland skating rink, fall, Dec. 25-**6**; Parker h., details, Jan. 1; Old Court h., raising, Mar. 5; Norway Iron Works, roof collapse, Mar. 19; Unitarian bu., Apr. 23-**7**.

" BRICK WALLS, incrustation on, Trautwine, *Am. Eng.* May 22-**5**; brick wk., permissable strain on, Bohme, *Sci. Am. Sup.* Mar. 20-**6**.

" BUFFALO ARMORY ROOF, *Eng. & Bu. Rec.* Oct. 29-**7**.

" BUSINESS, U. S. annual results, *Iron Age*, Sep. 3-**5**.

" CHICAGO FOUNDATIONS, Laurie, *San Eng.* Jan. 21-**6**.

" COCK ROACHES, how to get rid of, n. *San. Eng.* June 24-**6**.

" CONSTRUCTION, fire-proof, Collingwood, *San. Eng.* Feb. 11, Mar. 4, Apr. 1, 8, May 13, Aug. 26, Sep. 16, Nov. 13-**6**; details, Parker h., Boston, Jan. 1; Feb. 19; Mar. 19; details, balloon frames, June 18, Sep. 10, 17-**7**.

" DWELLING HOUSES, Henman, *Sci. Am. Sup.* May 12-**3**.

" EARTHQUAKE, Charleston, S. C., damage to, by, rep. *San. Eng.* Sep. 30; construction based on experience of, Bixby, Oct. 14-**6**.

" ENGINEERING, domestic, Potter bu., N. Y., *San. Eng.* June 17-**6**; plant, builders and contractors, Nov. 27; erection of towers St. Patrick's cath., N. Y., Dec. 4-18; Dec. 25-**6**; Jan. 18-29, Feb. 5-19, Mar. 5,26, Apr. 9, June 4, July 2, Sep. 17; dredging, Oct. 8; Dec. 17, 24-**7**.

" FOUNDATIONS, healthy, G. Brown, *San. Eng.* Feb. 7-21, Mar. 27, Apr. 10, May 15, June 12, July 17, 31, Aug. 14-**4**.

BUILDING, FIRE-PROOF BUILDINGS, *Iron Age*, June 29-7; do. construction, Collingwood, *San. Eng.* Feb. 11, Mar. 6, Apr. 1, 8, May 13, Aug. 26, Sep. 16, Nov. 13-6; construction for heavy, on compressible soil, Jenney, Dec. 10-5; *Am. Eng.* June 29-7; fixing blocks, *Sci. Am. Sup.* Feb. 14; in N. Y., June 20; and economical plastering, G. H. Hunt, Aug. 29-5. See also FIRE PROTECTION.

" FLOORS, decking, Lindsay's steel, *The Eng.* Oct. 7-7.

" FRAME CONSTRUCTION, Arey, *Sci. Am. Sup.* Aug. 23-4.

" FRAMEWORK, stresses in, graph. treatment, Graham, *The Eng.* Aug. 17, Nov. 2-3.

" GOV., erection of, Thayer, *San. Eng.* Apr. 22-6.

" GRAPHICS, cals. by drawing lines, R. H. Smith, *The Eng.* Dec. 21-3.

" HEAVY, fire-proof construct. on compressible soil, Jenney, *San. Eng.* Dec. 10-5.

" HOSPITAL, Army & Navy, Hot Springs, Ark. *San Eng.* Nov. 1-3; cottage, construct., Burdette, Miller hos., Greenwich, England, *San. Eng.* Apr. 24-4; Deer Is., Boston, Nov. 13-6; Park hill, Liverpool, *The Eng.* Jan. 16-5. See also ARCHITECTURE, HOSPITALS.

" HULL GEN. INFIRMARY, *San. Eng.* Aug. 21-3.

" IMPROVEMENTS, recent, T. M. Clark, *Soc. Arts*, Oct. 9-4.

" IRON, So. East Ry., *The Eng.* June 29-3.

" JAPANESE HOUSE, E. S. Morse, *Sci. Am. Sup.* May 29-6.

" HEIGHT OF, law governing, in Paris, *San. Eng.* Sep. 24-5; public, proposed law for erection of, Mar. 25-6.

" LAWRENCEVILLE SCHOOL, N. J. (construct. and fittings), *San. Eng.* Dec. 4-6.

" LIVERPOOL EXHIB., *The Eng.* June 11-6.

" MADISON CAPITOL, fall of, *San. Eng.* Nov. 29-3.

" MANHATTAN WAREHOUSE, *San. Eng.* Jan. 24-4.

" MASONRY, change of dimensions during hardening and compressive tests, Collingwood, *San. Eng.* Sep. 16-6; raising and moving, *Sci. Am. Sup.* Sep. 29-3.

" MATERIALS, concrete as a, Potter, *Sci. Am. Sup.* May 2-5; concrete construct. imps., *Sci. Am. Sup.* Nov. 7-5; mortars, plastering, etc., June 13-5; do. *Am. Arch*; hydr. lime, *Locom.* Sep.-5; mortars, remarkable effects of adding saccharine matter to, Hankey, Apr.-7. See also ENGINEERING, BUILDING.

BUILDING, MIDDLEBORO TOWN HALL, wide span cast iron arched ribs, *Sci. Am. Sup.* Dec. 20-4.

" MOVING, of large masses, *Sci. Am. Sup.* Dec. 29-3; movable buildings, Portrineau's, Mar. 1-4; movable market, May 9-5.

" N. Y., h's. for workmen, *San. Eng.* Nov. 22; Met. Opera h. Dec. 6, 27-3; lofty buildings, Keir, Jan. 3, 10; Mut. Life Ins. Co., May 22, June 12, 19-4; Equitable b. construct., Feb. 5, 12, Mar. 26, Apr. 9-7; do. *Eng. & Bu. Rec.* Oct. 8, 15, 15-7; kitchen boilers, Geo. Vanderbilt res. *San. Eng.* Feb. 26; tenement h. act of '87, May 14-7.

" PRESERVATION, by paraffine wax, obelisk, Caffall, *Sci. Am. Sup.* Jan. 30-6.

" PUBLIC, proposed laws for erection of, *San. Eng.* Mar. 25-6.

" ROMAN, construct., Oldrieve, *Sci. Am. Sup.* Aug, 22-5.

" ROOFS, stresses, graph. meth., Graham, *Am, Eng.* Jan. 4, 11; west side water wks., Chicago, Mar. 21, 28, Apr. 4, 11; No. Print wks. Apr. 18, 25, May 2, 9-4; coverings, J. Slater, *Sci, Am. Sup.* June 21-4; roofing tiles, Feb. 14-5; do. *Am. Arch*; slate roof coverings, Slater, *Sci. Am. Sup.* July 18-5; Huddersfield station, fall of, Lond. & No. West Ry. *Eng.* Oct. 16-5; do. *The Eng.* Nov. 13-5; Swansea station, strains, graph. treatment, Graham, July 27-3; shed, Carnac bridge terminus, Nov. 14-4; girder, Cen. India Ry. Oct. 9; iron, So. India Ry. Oct. 23-5, etc.; Fine Arts Court, Paris exhib. '89, Sep. 2, 16; of Ry. shops at Houwick, Sep. 23-7.

" SCHOOL, public, Brooklyn, *San. Eng.* Sep. 20-3.

" SERVICE PIPE RUNNING, table, Sager, *San. Eng.* Dec. 10-5.

" SHORING OF, Blashill, *Sci. Am. Sup.* Apr. 25-5.

" ST. MARKS, Venice, foundations of, Blackwell, *Sci. Am. Sup.* Oct. 3-5.

" ST. PETERS, Rome, hooping of dome of, *Sci. Am. Sup.* July 18-5.

" STABLES, Pickhardt's, *San. Eng.* Aug. 2, 16; wks. Nov. 1-3; floors, *Eng. & Bu. Rec.* Dec. 17-7; construct., A. W. Wright, *Sci. Am. Sup.* Nov. 15-4; do. Feb. 21-5.

" STEAM BOILERS, in 5th ave. res. *San. Eng.* Feb. 12-7.

" STONE, cause and prevention of decay of, Egleston, *San. Eng.* July 16-5; do. Feb. 5-26; Mar. 5, 12, 26, Apr. 16-30-7.

BUILDING STONE, decay of on ground level, *Van Nost.* Dec.-**5**; do. *Bu. News*; decay of, A. A. Julien, *Sci. Am. Sup.* Sep. 29-**3**; do. Mar. 22-**4**.

" STRAIN METER, *Am. Eng.* Jan. 18, 25, Feb. 1-**4**.

" TENEMENT HOUSES, *San. Eng.* July 19-**3**.

" THEATRE, Royal Alhambra, London, construct. *Am. Eng.* Aug. 15-**4**; Terry's iron work construct. in, Ende, *The Eng.* Sep. 23, Oct. 7-**7**.

" TRADES EXHIB. *Eng.* Apr. 6-**3**.

" VIENNA CATTLE MARKET, *Sci. Am. Sup.* Jan. 17-**5**.

" WATER, distrib. in Berkshire apart. h. *San. Eng.* Feb. 15-**3**; raising, in bu's. July 2-**5**; supply in city res. Nov. 13-**6**; filtering cisterns, Hiscox, *Sci. Am. Sup.* Aug. 23-**4**.

" WINDOW BALANCE, Dutton, *Soc. Arts*, Dec. 28-**2**.

BUILDINGS, 10 best in U. S., *Sci. Am. Sup.* Aug. 29-**5**; *Am. Arch.*

BURMAH, *Sci. Am. Sup.* Nov. 28-**5**.

BUSINESS, goodwill, value of, England, *Iron Age*, Apr. 29; failures, Boston, Sep. 16-**6**.

BUTTON WORKS, Warstone, Birmingham, *The Eng.* Sep. 24-**6**.

CABLES, hoisting, *Eng. News*, Mar. 5-**7**; mt. ærial, Gate of France, City of Grenoble, *Sci. Am. Sup.* Nov. 28; copper, gutta percha covering mach. Dec. 5-**5**.

CALCULATING INSTRUMENT, or cyl. slide rule, Thacher, *Eng. News*, Dec. 18-**6**; machs. *Iron Age*, July 2-**5**; do. averaging, Auchincloss, *Mech.* May 26-**3**; do. Edmundson's, *Sci. Am. Sup.* July 18-**5**; do. do. *Eng.* May 1-**5**.

CALICO PRINTING MACHINE, 12 color, *Sci. Am. Sup.* Oct. 8-**7**.

CALORIC ENGINE, Victor, *Iron Age*, July 2-**5**; Buckett, *Eng.* Apr. 20-**3**.

CANADA, trade, *Eng. News*, Dec. 4-**6**; *Iron Age*, June 4-5; and U. S. in '84, Preece, *Sci. Am. Sup.* Mar. 21-**5**; customs tariffs, *The Eng.* Sep. 9-**7**.

CANALS, Baltic and North Sea, *Eng. News*, Mar. 13, Sep. 25-**6**; and Westphalien, *The Eng.* June 17-**7**.

" BELGIUM, nav. in, Gobert, *Eng. News*, Mar. 3-**3**.

" BIRMINGHAM AND BRISTOL, *The Eng.* June 24-**7**.

" BOATS, steam propulsion for, *Iron Age*, Feb. 18-**6**.

" BRUSSELS SHIP, *Eng. News*, Dec. 18-**6**.

" BUILDER, De Lesseps, *Eng. News*, June 6-**5**.

CANALS, CANADIAN SYSTEM, *Iron Age*, Mar. 15-**3**.
" CHANNEL, ship, *The Eng.* Aug. 3-**3**.
" COLORADO, of, irrig., rep. *Eng. News*, Dec. 25-**6**; and railroads in, *Sci. Am. Sup.* Sep. 25-**6**; *Eng.*
" CORINTH, Specht, *Eng. News*, June 7-**4**; *Am. Eng.* Nov. 28-**4**; *Sci. Am. Sup.* Feb. 23-**4**; Nov. 13-**6**; *The Eng.* June 6-**4**; Oct. 8-**6**.
" ERIE, *Eng. News*, Mar. 13, May 22-**6**; rep. *Am. Eng.* Feb. 20; E. Sweet, Feb. 27; commerce of, Mar. 6; enlargement, Mar. 27-**5**.
" GREAT WESTERN MARITIME, *The Eng.* Aug. 3-**3**.
" HARLEM R., ship, *Eng. News*, Aug. 13-**7**.
" HENNEPIN AND ERIE, *Eng. News*, Mar. 13-**6**.
" HOLSTEIN, ship, *Iron Age*, Aug. 6-**5**.
" IRRIGATION, of Col., rep. *Eng. News*, Dec. 25-**6**.
" ISTHMUS, Stevens, *Am. Eng.* May 29-**5**.
" JORDAN, proposed, Gordon, *Eng. News*, Nov. 3-**3**.
" LIFTS, hydr., W. R. Hutton, *Eng. News*, May 17; bridge, Penn, Searles, May 31-**4**; *Iron Age*, Feb. 10-**7**; French and Belgian, *Mech.* Nov.-**5**; Fointenettes, France, Clark, *Eng.* July 10-**5**; presses for, *The Eng.* Oct. 15-**6**.
" LOCK GATES, circular, strains on, Romanes, *The Eng.* Nov. 21-**4**; do. Jan. 30-**5**.
" MANCHESTER SHIP, Lyster, *Am. Eng.* Apr. 15-**6**; and Tehuantepec ship Ry. Nov. 19-**5**; *San. Eng.* Aug. 26-**6**; *Ry. Gaz.* Sep. 16; map, Oct. 7-**7**; H. S. Smith, *Van Nost.* Nov.-**4**; map, *Sci. Am. Sup.* May 5-**3**; Nov. 14-**5**; Aug. 21-**6**; *Eng.* Jan. 26, Feb. 2, Mar. 9-23, Apr. 27, Dec. 28-**3**; Jan. 18, Feb. 1, Mar. 7, Apr. 25, May 16, Aug. 29-**4**; July 16, Dec. 17-**6**; Aug. 12, Sep. 2, 16, Oct. 7-**7**; *The Eng.* May 4, 11, June 8-**3**; map, Jan. 4; do. Nov. 14; May 16-**4**; June 25-**6**.
" MORRIS, and inclined planes, H. M. Wilson, *Sci. Am. Sup.* Feb. 24-**3**.
" N. Y. STATE AND WEST SHORE R. *Eng. News*, Dec. 22-**3**.
" NEUFFORSE, hydr. elevator at Fontinettes, *Sci. Am. Sup.* Feb. 21-**5**.
" NICARAGUA SHIP, *Eng. News*, May 15-**6**; Peary, *Iron Age*, Nov. 17-**7**; do. *Ry. & Eng.* Oct.-**7**; treaty, text, *Am. Eng.* Dec. 26-**4**; vs. Panama, Jan. 2; Ammen, Jan. 30; Stevens, Jan. 30, Feb. 20; interoceanic, Menocal, Nov. 26-**5**; (Engs. Club, Phil.), Mar- 18-**6**; Nov. 30-**7**; *Eng.* Mar. 6-**5**.

CANALS, NICE IRRIGATION WORKS, *Eng.* Feb. 20-**5**.

" NORTHERN ILL., *Eng. News*, May 1-**6**.

" NORTH SEA AND BALTIC, *Eng. News*, Sep. 25-**6**; Baltic & Westphalian, *The Eng.* June 17-**7**.

" PALESTINE, H. J. Martin, *Eng. News*, Aug. 11, Oct. 6-**3**.

" PANAMA WORKS, *Eng. News*, Jan. 6; maps, Aug. 4, 11; culebra, or great cut, Dec. 8-**3**; marine dredge at Colon, Apr. 5; May 3; Aug. 16-**4**; Aug. 8, 22, Nov. 21-**5**; Apr. 3; rep. May 22; n. Aug. 14; Jameson, Sep. 25-**6**; July 30, Aug. 13, Nov. 19-**7**; *Iron Age*, Sep. 6-**3**; July 10, 31, Sep. 4, Nov. 20-**4**; *Mech.* Sep. 15-**3**; Apr. 26, Sep.-**4**; *Am. Eng.* Oct. 3, Dec. 19-**4**; June 17-**6**; Aug. 17-**7**; n. *Ry. Gaz.* May 16-**4**; *Van Nost.* Mar.-**3**; Feb., July-**6**; *Fran. Inst.* Nov.-**4**; map, *Sci. Am. Sup.* Jan. 13, Nov. 24-**3**; Jan. 5-**4**; Oct. 23, Dec. 18-**6**; Boyd, June 4; July 23, Oct. 8-**7**; Hurlbert, *Forum*, Nov.-**7**; *Eng.* July 20, Sep. 21, Oct. 19-**3**; Apr. 25-**4**; Feb. 6, Apr. 2, July 2-**6**; Aug. 5, Nov. 25-**7**; *The Eng.* Aug. 6-**6**; Boyd, Apr. 15. 22, July 22-**7**.

" PONTILOFF, Russia, *Eng.* July 10-**5**.

" PROJECTS, Newcome, *Van Nost.* July-**3**; *Naut. Mag.*

" ROTTERDAM, *Eng. News*, Aug. 28-**6**.

" RUSSIAN SHIP, n. *Eng. News*, Sep. 4-**6**; *Iron Age*, Dec. 4-**4**.

" SLUICES, aut. *Eng*, *News*, Mar. 13-**6**.

" SPEED ON, Conder, *Van Nost.* Jan. Feb.-**5**; *Sci. Am. Sup.* Apr. 12-**4**; *Eng.* Feb. 15-**4**.

" STEAM ON, *Eng.* Jan. 29-**6**.

" ST. MARY'S FALLS (Sault Ste. Marie), and locks, *San. Eng.* Mar. 25, Apr. 1-**6**; *Ry. Gaz.* Mar. 4-**7**.

" ST. PETERSBURG, to Cronstadt, *Eng. News*, Dec. 1-**3**; maritime, *Sci. Am. Sup.* July 11-**5**.

" SUEZ, *Eng. News*, June 23-**3**; Specht. Sep. 26-**5**; and Nicaragua, May 15-**6**; *Iron Age*, Oct. 2-**4**; Lesseps, July 23-**5**; *Am. Eng.* Jan. 2, Oct. 8-**5**; and Euphrates Val. Ry. *Van. Nost.* Mar; a second, Sep.-**3**; Rundell, Jan.-**4**; commiss. rep., Flamant, Nov.-**6**; traffic *Ry. & Eng.* July-**7**; do. *The Eng.* May 27-**7**; *Sci. Am. Sup.* Sep.-**3**; *Eng.* Dec. 7-**3**.

" TANCARVILLE, and sewer, Havre, France, excav. ap. on, *San. Eng.* July 2-**7**.

" TOWING, Klett, *Iron Age*, Apr. 26-**3**; do. *Mech.* Apr. 21-**3**.

CANAL TRANSPORTATION, cost of on a deeper, *Iron Age*, June 17-**6**; and river meths., Klett, *Van Nost.* Apr.-**3**; Brit. and U. S. *The Eng.* Sep. 3-**6**.

CANDLE MACH., moulding, *Sci. Am. Sup.* Jan. 31-**5**; do. Price, *Eng.* May 22, 29, June 5; Inv's. exhib. July 3-**5**; Barlow, Jan. 7-**7**; and wks., Field's, *The Eng.* Dec. 26-**4**; making mach. June 26-**5**.

CAN-SOLDERING AP., Merriam's, *Iron Age*, July 23-**5**.

CANVAS TESTING MACHINE, O'Connor, *Eng.* Feb. 26-**6**.

CAPE OF GOOD HOPE, U. S. trade with, *Iron Age*, July 22-**6**.

CAPITAL AND LABOR. See also LABOR.

" AND LABOR, probs. in profit sharing, Kent, *Mech.* sup. June **7**; do. *Ry. & Eng.* Aug.-**7**; capital's need for high-priced labor, Partridge, *Am. Eng.* Dec. 22, 29-**6**; comparative econ. (cost, interest &c.) Cobb, *Van Nost.* Dec.-**6**; riddle of the sphinx, Bayles, addr. *Sci .Am. Sup.* July 10; labor probs., Thurston, Aug. 21, 28-**6**.

" BUSINESS PROFITS, F. A. Walker, *Sci. Am. Sup.* June 4; cost in manufs., H. Metcalfe, Aug. 6; labor probs., Emery, Dec. 10-**7**; capital (and percentages going to labor) in storm and calm, *Locom.* May-**7**; source of business profits, F. A. Walker, *Soc. Arts*, Mar. 24-**7**; social sustenance, Philpott, *Pop. Sci.* July–Dec.-**7**; economic disturbances since '73, Wells, Sep.-**7**.

CARBONIC ACID, in liquid and solid states, *Iron Age*, May 13-**6**. See also CHEMISTRY, CARB. ACID.

CARDING ENGINE, Hubner, *Sci. Am. Sup.* Oct. 16-**6**; machs., Truxler's Apr. 7-**3**; do. Oct. 22-**7**; engine, Hetherington, eng. *The Eng.* Sep. 16-**7**.

CARPET CLEANER, pneu., Warsop, *Sci. Am. Sup.* Dec. 24-**7**; *Eng.* Nov. 4-**7**.

CARRIAGE WHEELS, tests, *Fran. Inst.* July-**6**. See also WHEELS.

CASK MAKING MACHINE, Thornewill's, *Sci. Am. Sup.* Aug. 15-**5**; Wright's, *Eng.* Sep. 14-**3**.

CAVE, marble, Missouri, *Sci. Am. Sup.* Feb. 7-**5**.

CAYLEY, ARTHUR, por. *Sci. Am. Sup.* Nov. 3-**3**.

CELLULOID, *Iron Age*, Mar. 17-**7**.

CEMENT MILL and testing ap., Faija's, *The Eng.* Dec. 4-**5**.

CEMENTS, tests, Faija, *Eng. News*, Apr. 21, May 12; do. Mann, May 19; do. portland, strength, May 19; rosendale manuf., Ulster cty., N. Y., Sep. 15; portland, mixtures, Dec. 15-**3**; hardening, Perrodil, Nov. 29-**4**; concrete, cost of, E. Low, Jan. 24; slag, Ransome, Feb. 21; portland, adulterations, Fresenius, Apr. 4; tests, Boston drainage wks., E. C. Clarke, July 4; strength, effect of sand on, July 11; portland, "Porte de France," Nov. 7; do. Smedt rep. Dec. 5, 19; tests, rep. Dec. 19, 26-**5**.

" TESTS, chemical, *Eng. News*, Jan. 30, Feb. 13; mortars and concretes, qualities, Feb. 6; testing, May 1; testing mach., Brendlinger, May 15-**6**; German, Jan. 29; mach. Bohme, Mar. 26; bags, vs. bbls. for, May 21, 28; effects of magnesia, June 4; manuf. June 18; from blast furnace slag, June 25; hydr. June 25; manuf. at harbor wks., Calais, Guillain, Sep. 3; effect of sugar, H. Porter, Dec. 24-**7**.

" SLAG, *Iron Age*, Feb. 19-**5**; manuf. from blast furnace cinder, Aug. 12-**6**; do. in U. S. Apr. 21-**7**; tests, Sondericker, *Mech.* Dec; effect of sugar on, Parsons, Dec.-**7**; mortars, influence of sand on strength of, Arnold, *Am. Eng.* Jan. 11-**4**; Faija, July 16-**5**; do. *Iron Age*; and silicate of lime, Waters, *Am. Eng.* Jan. 7-**6**; portland, manuf., Ransome, Sep. 21-**7**; do. tests at long dates, *San. Eng.* July 2; do. testing, for Calais and Boulogne harbor wks., Guillain, July 9-**7**; hydr. manuf. from blast furnace slag, Friswell, *Eng. & Bu. Rec.* Nov. 12; influence of sugar on, expts. Dec. 24-**7**.

" TESTING MACHINES, Riehle, Fairbanks, *Ry. Gaz.* June 19-**5**; tests, Boston drainage wks., E. C. Clarke, Jan. 22; tests, sys. of, Am. Soc. C. E. rep. Mar. 5-**6**; do. Swiss, Jan. 7-**7**; manuf. and tests, Mann, *Van Nost.* Sep.-**3**; do. Faija, Nov.-**4**; mortars, influence of sand on strength of, Arnold, Jan; portland, Faija, Sep.-**5**; mixtures, Tetmaier's, Feb.-**6**; portland, Ransome imp., Friswell, *Fran. Inst.* June, July-**7**.

" NATURAL, Japanese soils, Korschelt, *Sci. Am. Sup.* Jan. 27; portland, manuf., Middleton, May 26; manuf., Ulster cty., N. Y. Oct. 6-**3**; tester, Fairbanks, Feb. 16; and mortars, Tuthill, Sep. 6-**4**; mortars, influence of sand on strength of, Arnold, Feb. 7; slag, Mar. 28; of the Gate of France, City of Grenoble, Nov. 28-**5**.

CEMENTS, TESTS, rep. *Sci. Am. Sup.* Jan. 30; magnesian, in masonry, accidents due to, Claye, Nov. 13; do. Dec. 11; mortar, effect of adding saccharine matter to, Crompton, Dec. 25-**6**; kiln, Dietzsch, July 16; portland, Ransome, Nov. 19-**7**; blast furnace slag and slag cement, as compared with portland, C. S. Schumann, *Locom.* Nov.-**6**; hydr., nat. and artif., comparative values, Cummings, *Soc. Arts*, Nov. 10-**7**.

" PORTLAND, strength, *Eng.* Aug. 17-**3**; mach., Michele, Mar. 6, May 1; manuf., Spoor, June 12, Aug. 14-**5**; under compression, Am. Soc. C. E. circular Feb. 12; Eng. Dept., Wash., rep. Nov. 27-**6**; tests, Feb. 18; mach. July 1-**7**.

" PORTLAND, mill and plant, *The Eng.* Oct. 19, Nov. 30-**3**; testing mach., Michele's, June 19-**5**; portland, Arlesey wks. Oct. 8; do. production, U. S., n. Nov. 26-**6**; effect of sugar on, Barnes, Feb. 11; portland, Ransome imp., Friswell, Mar. 4; do. magnesia in, Mar. 18; do. Faija, Apr. 22; do. tests, Middleton, May 20; hydr. manuf. from blast furnace slag, Friswell, June 10; port. manuf., Ransome, Sep. 9-**7**.

CENTRAL AMERICAN CRISIS, *Iron Age*, Mar. 26-**5**; republics, Apr. 1-**6**.

CENTRIFUGAL MACH., &c. Inventor's exhib. *Eng.* Nov. 20-**5**.

" PUMPS. See PUMPING ENGS; PUMPS.

CEYLON, U. S. trade with, *Iron Age*, July 7-**7**.

CHADWICK, EDWIN, (book n. of wks. Health of nations.) *The Eng.* Sep. 16-**7**.

CHAINS, without welding, *Eng. News*, Apr. 2; use and care of, S. H. Adams, Aug. 6-**7**; rolling machs., Jacker's, *Iron Age*, May 27-**6**; early hist. of, Smith, *Mech.* Mar. 29-**4**; Adams, Aug.-**7**; manuf. mach., without welding, *Am. Eng.* June 6-**4**; Adams, July 6-**7**; steel, without welding, Apr. 6-**7**; do. *Sci. Am. Sup.* July 26-**4**; do. Apr. 16-**7**; casting, brass, E. India, C. P. Clarke, Nov. 27-**6**; and cables, Traill, book n. *The Eng.* Sep. 18-**5**; casting in solid steel, Gautier, Oct. 22-**6**; steel, manuf. without welding, Oury, Mar. 4; for lifting and hauling, use and care of, Adams, July 8-**7**.

CHAPIN, CHESTER W., *Ry. Gaz.* June 8, 15-**3**.

CHARCOAL, burning, Sweden, *Iron Age*, Mar. 12-**5**; manuf. in kilns, *Sci. Am. Sup.* Dec. 15-**3**; do. Feb. 2-**4**; furnaces, old, *Locom.* Oct.-**5**.

CHASE, PLINY EARLE, *Fran. Inst.* Sep.-**7**.

CHEMISTRY, notes, *Fran. Inst.* Jan.-Mar, May-July-**7**; industrial, Leeds, *Sci. Am. Sup.* Mar. 3-**3**; Taggart, Nov. 22-**4**; indus. *Eng.* June 13; on Tyne, July 18-**4**; Crookes, addr., Brit. Assoc. *The Eng.* Sep. 3-**6**.

" AIR, water and soils, det. of nitric acid in, Grandval, *Sci. Am. Sup.* Oct. 3-**5**; ap. for es. carb. acid in, Sep. 4-**6**; do. Van Nuys, Jan. 22-**7**.

" ALKALI PROC. *Sci. Am. Sup.* Sep. 17-**7**; alkaloids, constitution of, Sudtler, Dec. 15-**3**; June 12-**6**.

" AMMONIA, product from nitrogen of minerals, Beilby, *Sci. Am. Sup.* Apr. 25, May 2-**5**; sulphate manuf., Gruneberg's ap. for, W. Smith, Nov. 6-**6**; sulphate plant, Simon, Stafford gas wks. *Eng.* Oct. 14-**7**.

" ANALYSIS, curiosities of, *The Eng.* June 8-**3**.

" ATOM AND CRYSTAL FORM, compared, theory, Barlow, *Sci. Am. Sup.* Mar. 20-**6**.

" BENZINE FROM COAL GAS, G. E. Davis, *Sci. Am. Sup.* Oct. 4-**4**.

" BLEACHING, AP., Morris, *Sci. Am. Sup.* Feb. 24-**3**; proc. Feb. 27, May 1-**6**; processes, May 7-**7**; proc., Mather, *The Eng.* Mar. 19-**6**.

" BORAX, Cal., hist. of, Robottom, *Sci. Am. Sup.* Dec. 25-**6**; Feb. 19-**7**; boric acid, Gooch, Apr. 30-**7**.

" CAMPHOR, Japanese, *Sci. Am. Sup.* Oct. 25; carbolic acid, French, May 24; carbon and its compounds, actions with, Gore, Nov. 8-**4**.

" CHLORINATION PROC., Newbery-Vautin, *Sci. Am. Sup.* Nov. 19-**7**; chloroform manuf. Sep. 18-**6**.

" COAL-TAR, and colors derived from it, L. M. Norton, *Soc. Arts*, Dec. 11-**4**; coal distil. and ammonia product, *The Eng.* Dec. 7-**3**.

" COLORS, common and poisonous, *Sci. Am. Sup.* June 19-**6**; constitution and physiolog. action, connection between, Brunton, Oct. 30-**6**; creosote, Hager, Jan. 20-**3**; crystal form and atom compared, theory, Barlow, Mar. 20-**6**.

" DISTIL., continuous ap. *Sci. Am. Sup.* Sep. 10; and concent. of chem. liquids, proc., G. Anderson, Sep. 17-**7**; dyeing, fixing coloring matter upon cotton by tannin, Witt, Aug. 1-**5**; do. aniline black on cotton goods, May 1-**6**; dyes, aniline, in dress materials, O'Neill, Jan. 3-**5**; do. alizarine, Feb. 27-**6**.

CHEMISTRY, ELEMENTS, combining wts., vols. and spec. gravs. compared, table, W. Farmer, *Sci. Am. Sup.* Sep. 20-**4**; do. new, Germanium, Pringle, Nov. 6, 27-**6**; enameling, Vanes, June 2-**3**; equivs., ap. to determine, H. N. Morse, May 23-**5**; exam. Oct. 9-**6**.

" FILTRATION by soluble and volatile filters, Gooch, *Sci. Am. Sup.* Oct. 31-**5**; flame, Fletcher, Mar. 5-**7**; fl uorine isolation, Jan. 22-**7**; black ash revolving furnace, W. Smith, Nov. 19-**7**. of foods and nutrition, Atwater *Soc. Arts*, Apr. 22-**6**.

" GASES, liquefaction, Dewar, *Sci. Am. Sup.* Aug, 9-**4**; do. Mar. 7; do. Coleman, May 16-**5**; condens. of, *The Eng.* Feb. 1-**4**; glucose, Brewer, Apr. 17-**6**; glycerine, Berghaus, Apr. 14, June 23-**3**; do. and its uses, Alcock, July 4-**5**; green, emerald, properties and manuf., R. Galloway, Sep. 20-**4**.

" HOPS, *Sci. Am. Sup.* Feb. 24-**3**; hydrogen manuf. ap. Dec. 1-**3**; do. boiling point of, E. J. Mills, Jan. 17-**5**; do. amalgam, Molloy, *The Eng.* Mar. 7-**4**.

" IODINE, Ehrmann, *Sci. Am. Sup.* Apr. 5-**4**.

" LABORATORIES, Wyandotte, Mich. *Iron Age*, Nov. 15-**3**; Paris School of Physics & Chem. *Sci. Am. Sup.* June 28-**4**; wire ap. for, Hopkins, *Sci. Am. Sup.* June 13-**5**; Zurich, Feb. 12; U. S., N. Y. pub. stores, Benjamin, Mar. 19-**7**; lab. refrigerators, *Eng.* Mar. 19-**6**.

" LIQUEFACTION, of, C. F. Cross, *Sci. Am. Sup.* Mar. 24-**3**.

" MANUFS., alkali proc. *Eng.* July 8-**7**; micro-organisms, changes in relation to, *Sci. Am. Sup.* Apr. 25-**5**; det. of nitric acid in sol. of permanganate of potassium, Oct. 2-**6**.

" OILS, Japanese camphor, Oishi, *Sci. Am. Sup.* Jan. 24; 3 Chinese fixed, R. H. Davies, May 9; essential, Aug. 8-**5**; of peppermint, Todd, Feb. 19-**7**.

" ORGANIC SUBS., series of, Schnurrer, *Sci. Am. Sup.* July 12-**4**; oxygen production by Brin's proc. Dec. 10-**7**.

" PARAFFIN, fusion point, *Eng.* Apr. 23-**6**.

" PERFUMES, flowers used in, *Sci. Am. Sup.* Apr. 14; and essential oils, Naudin, Oct. 13-**3**; manuf., formulas for, Muskegon, Jan. 17-**6**; manual, Apr. 25-**5**.

" PHOSPHATES of Picardy, *Sci. Am. Sup.* Mar. 12-**7**; pigments, J. M. Thompson, Oct. 31-**5**.

CHEMISTRY, POISONS, antidotes for, chemicals used in manufs. *Eng. News*, Dec. 11-**6**.

" PROGRESS, *Fran. Inst.* Sep.-**6**; Roscoe, *Sci. Am. Sup.* Nov. 1-**4**; Bolton, June 19-**6**.

" REFRACTOMETER, Bertrand's, *Sci. Am. Sup.* July 3-**6**.

" SACCHARINE, sweet coal-tar product, Fahlberg, *Sci. Am. Sup.* Nov. 12-**7**; do. inv. of, Remsen, *Locom.* Feb.-**7**; salt, manuf., Middleborough, Bell, *Sci. Am. Sup.* Oct. 1-**7**; saltpetre, sources, Lock, Feb. 13-**6**; science, Brit. Assoc., Gladstone, Oct. 27-**3**; silver deposition on glass, F. L. James, Nov. 29-**4**; soaps, medicated, J. V. Shoemaker, Aug. 22-**5**; do. toilet, manuf., C. A. Wright, Dec. 5, 12-**5**; soap bubbles, Rucker, Feb. 5-**7**; soda, manuf. by ammonia proc., Kœbig, July 12-**4**; do. sulphite, Boake, Feb. 13-**6**; do. nitrate, Chilian, manuf. Aug. 21-**6**; soda ash revolving furnace, Sep. 13-**4**; sodium proc., Castner, Mactear, May 21-**7**; do. *Fran. Inst.* June-**7**.

" SOLUBILITY of chemicals in water, table, *Sci. Am. Sup.* Dec. 20-**4**; solution, nature, theory of, Pickering, Feb. 12-**7**; sugar, centrif. extractors, Gibson, Oct. 1-**7**; sulphur, Aug. 11-**3**; do. extraction of, Vincent, May 10-**4**; do. occurrence and extraction, Lock, Aug. 30-**4**.

" TANNIC ACID, det. in tanning materials, Darton, *Sci. Am. Sup.* Sep. 12-**5**; tannin, sources, *Fran. Inst.* June-**7**; do. Kendall, *Sci. Am. Sup.* Feb. 7-**5**; do. Trimble, July 16-**7**; toning baths, Ashman, Dec. 13-**4**; urine anal. Sep. 17-**7**.

" WALL PAPER, test for, *Locom.* June-**7**; water, oxygenated, Ebell, *Sci. Am. Sup.* July 4-**5**; water-proofing, cupro-ammonium sols. for, paper and veget. tissues, July 5-**4**; rain water, chlorine in, Feb. 19-**7**; wines, coloration of, Cazeneuve, July 10-**6**; white lead, by sublimation, *Eng.* Sep. 4-**5**; wks., of Widnes, Nov. 2-**3**; do. Flint, Sep. 26-**4**; do. Addinell, Sep. 4-**5**.

CHESBROUGH, ELLIS S., por. *Eng. News*, Aug. 21-**6**; *San. Eng.* Aug. 26-**6**; por. *Sci. Am. Sup.* Oct. 9-**6**.

CHEVREUL, EUGENE, por. *Sci. Am. Sup.* Sep, 18; interview, Nov. 27-**6**.

" MICHEL E., por. *Sci. Am. Sup.* Nov. 1-**4**.

CHICAGO, pub. wks. *Eng. News*, Oct. 20-**3**; do. rep. May 30-**5**; growth in 50 years, *Iron Age*, Mar. 17-**7**; main drainage and supply, map, *Am. Eng.* Feb. 9-**7**; growth of trade and pop. *Ry. Gaz.* Feb. 19; pork packing, Nov. 19-**6**; do. in West, Apr. 29-**7**; foundations, Laurie, *Sci. Am. Sup.* Feb. 6-**6**; trade, '86, rep. *The Eng.* July 8-**7**.

CHILI, trade with U. S., *Iron Age.* Aug. 16-**3**; May 7, June 25, Aug. 20-**5**; trade, Apr. 1; developments in, Sep. 9-**6**.

CHIMNEYS, HIGH, sizes, Kent, *Eng. News*, Dec. 27-**4**; construct., H. F. Mills, Mar. 15; Bancroft, Mar. 29, June 21; July 19; leveling, Wilber, Aug. 9-**4**; July 11; Pac. and Merrimac mills, Lawrence, Mass., H. F. Mills, July 18; St. Rollox, Glasgow, Bancroft, July 25; tall, Bancroft, Sep. 12, Oct. 31; do. June 13, Aug. 22, Nov. 14, Dec. 26; N. Y. steam Co., July 18-**5**; climber, Aug. 28; draught, dimens. Oct. 2, 9-**6**.

" HIGH, *Iron Age*, May 8; draught gauge, June 19; construct. Mar. 27, Apr. 17, Nov. 13-**4**; sizes, table, Jan. 29, "crinoline," Cambria Iron Co., Webb, July 9; Aug. 13-**5**; highest, Feb. 11; staging, novel, June 24-**6**; construct., Karr, Apr. 7-**7**.

" HIGH, construct., H. F. Mills, *Mech.* Mar. 22, Apr. 12; May 3; Nov.-**4**; do. *Locom.* draught gauge, *Locom*; do. *Mech.* June 14-**4**; sizes, table, Kent, Jan; climbing, Feb; table, Aug; "crinoline," Cambria Iron Co., Johnston, Pa., G. Webb, Sep.-**5**; climber, Nov.-**5**.

" HIGH, sizes, Kent, *Am. Eng.* Nov. 28-**4**; factory, Apr. 15; staging, Coggin, June 3; circular, Mechernich, near Cologne, J. M. Wood, Sep. 1-**6**; do. *San. Eng.* Sep. 2-**6**; climbing ap. Oct. 1-**5**; draught, *Van Nost.* Jan; dimens. of, Pinzger, Sep.-**3**; construct., Seddon, Oct.-**4**; do. Bancroft, Aug.-**5**.

" HIGH, draught, *Sci. Am. Sup.* Jan. 27-**3**; climbing and straightening, Sanderson's meth. Aug. 9-**4**; Mechernich circular, Wood, Sep. 25-**6**; Karr, Jan. 29; distillery, Schmidt, Dec. 10-**7**; construct. *Locom.* Aug.-**4**; tall, table, Jan.-**5**; stability of, June-**6**; Nov.-**7**.

" HIGH, laddering, *Eng.* May 13-**7**; at Bradford, fall of, Apr. 20-**3**; do. *The Eng.* Feb. 9-**3**; sizes, table, Kent, Aug. 28-**5**; Mechernich circular, Cologne, Ger., J. M. Wood, Sep. 3-**6**.

CHINA, Chinese wts. and measures, *Eng. News*, Sep. 29-**3**; and Japan, Rys. in, Oct. 17-**5**; first Ry. Jan. 9; Ry. construct. May 29-**6**; engineering enterprises in, Aug. 6, Sep. 17-**7**; prog. in, *Iron Age*, Aug. 30; U. S. trade with, in '82, Sep. 20, 20, 27; measures, foot rule, Sep. 20-**3**; metallurgy, Aug. 14-**4**; music, wts. and measures, origin, Jan. 8; trade, Aug. 13, Sep. 17-**5**; do. U. S. with, Dec. 9-**6**; Ry. locom., first, *Mech.* Dec.-**4**; music, wts. and measures, origin, Jan; Ry., first, Nov.-**5**; iron foundries and rice pan castings, Dec.-**4**; do. *Van Nost.* Oct.-**4**; do. *Chem. News;* Rys. in, *Ry. Gaz.* Sep. 25-**5**; and Japan, scientific prog. in, *Sci. Am. Sup.* July 7-**3**; North, Kaiping Colliery, *Eng.* Nov. 27-**5**; Ry. development, *The Eng.* Jan. 15-**6**.

CHRONOGRAPH regulator, *Eng.* Dec. 24-**6**.

CINCINNATI bd. of pub. wks. rep. *Eng. News*, July 7-**3**.

CITIES. See also names of do.

" ENGLISH and Am., pop. and debt, *Eng. News*, Jan. 10-**5**; Am. pop. growth, Jan. 15; munic. pub. wks., Appleton, July 2; traffic growth, Oct. 15-**7**.

" EUROPE, of, and U. S., *Iron Age*, Feb. 1-**3**; commercial, law of growth, June 4-**5**; Am. pop. growth, Hering, n. Mar. 17-**7**; Europe and U. S. *Mech.* Feb. 3-**3**; pops., U. S., F. A. Walker, *Am. Eng.* Mar. 20-**5**; cab and carriage service, *Ry. Gaz.* Aug. 31-**3**; and water transport. between Miss. r. and Lakes, June 24-**7**; of Europe, pop. *Van Nost.* Apr.-**3**; snow in, n. Apr.-**6**; traffic growth, *St. Ry. Jour.* Dec.-**7**; pops., Europe, *Sci. Am. Sup.* July 28-**3**; do. *The Eng.* Apr. 13-**3**; stat., Bazalgette, Jan. 18-**4**.

CLARK, ALVAN, *Electric.* Sep.-**7**.

CLOCKS. See also CHRONOGRAPH.

" WATER, *Eng. News*, June 30-**3**; time measuring, hist. Apr. 4-**5**; indus., Conn., *Mech.* Oct. 6-**3**; and watches, Apr. 19-**4**; signal, *Fran. Inst.* Mar, Nov.-**3**; elec., contact maker, Mar.-**6**; do. Thomas, *Electric.* Jan; do. Stone, June-**3**; do. horology, Terry, Mar, May, June-**5**; do. Synchronous Time Co., Boston, Oct.-**6**.

" ELECTRIC, and teleg. circuits, Buell, *Elec. Rev.* May 19; do. synchronized, R. sys., Standard Time Co. May 24; do. do. N. Y. July 26; do. Nov. 29-**3**; do. Feb. 14, Oct. 25; do. setting mechanism, Kettell's, Oct. 25-**4**.

CLOCKS, ELECTRIC, *Elec. Rev.* July 18-**5**; self-winding, Oct. 16-**6**; Auburn, Sep. 10; watchman's, Nov. 26; elec. Dec.. 24-**7**.

" ELECTRIC TIME DISTRIB., H. L. Bailey, *Elec. World*, July 18; elec. watch, Nov. 28-**5**; do. contact maker, Apr. 24; do. sys., Warner, May 29; do. self-winding, Pond, July 24; do. Tabony time register, Oct. 16-**6**; do. Holcombe's sys. May 21-**7**.

" SPHERICAL, French, 17th cent. *Sci. Am. Sup.* July 21-**3**; Chehab's hydr. Sep. 13; water, or clepsydra, Dec. 20-**4**; do. Magnus, Mar. 21-**5**; and watches, watch without hands, June 19; elec., pendula propul., Van der Weyde, July 31-**6**.

" ELECTRIC SIGNAL, G. W. Blodgett, *Soc. Arts*, Nov. 23-**2**; turret, Lucknow, Benson, *Eng.* Aug. 28-**5**; at Royal Court of Justice, *The Eng.* Dec. 21-**3**; horology at Inv's. exhib. Aug. 14, Oct. 30-**5**.

CLOTH MEASURING AND MARKING MACHINE, *Sci. Am. Sup.* Feb. 6-**6**; plaiting do. June 6-**5**; pressing and tentering do. Mar. 14-**5**; stretching, do. Sep. 8-**3**; do. Birch's, Mar. 27-**6**.

COAL, dust fuel, *Eng. News*, Apr. 7-**3**; spontan. combust. in mines, Durand, Mar. 8-**4**; in China, May 15-**6**; Am. coals, calorific value, Oct. 16-**6**; mine pits, Dortmund, Tomson, Nov. 5; mine shaft, Demer R. Dec. 3; stocking, Dodge, Dec. 17-**7**.

" ALABAMA, and iron in, Hunt, *Iron Age*, Mar. 8; prod., Grt. Brit. Mar. 29; do. U. S. Apr. 12; spontan. combust. Apr. 26; formation, De Saporta, May 8; coke indus. May 17; bitum., evap. power of, July 5, Aug. 16; slack mach. Aug. 30; coke from, porosity, Aug. 30; coking, Jameson proc. Oct. 25-**3**.

" COKE OVENS, Jameson, *Iron Age*, Feb. 28; Monongahela district, Apr. 17; Buffalo trade, July 3; ovens, Hoffman, Nov. 6; and iron fields of South, Dec. 11-**4**; coke, spec. grav. Jan. 1; and iron ore product, Ohio, Apr. 23; calorific value of, May 14; anthracite and bitum. compared. May 21; spontan. combust. July 9; mining, Belgium, Sep. 10; coke, test of flat-top, Sep. 17; do. Tenn. Sep. 24; handling mach., Cleveland, Oct. 8; washing mach., Bell-Ramsey, Oct. 22; coke manuf. Oct. 15, 22; coke in Penn. Oct. 29, Nov. 5, Dec. 3; bitum. tests, Dec. 17; fields, No. Car. Dec. 31-**5**.

COAL, ELEVATOR, AND ORE, Columbus, O. *Iron Age*, Mar. 25; and Iron Co., Dayton, Apr. 1; and iron ore, Ala., English capital in, Apr, 22; prod., Grt. Brit. Apr. 22; and iron lands, Jonesboro, Ala. May 20-**6**; barges vs. schooners, Jan. 6; Duluth trade, Mar. 3; authra., cost of mining, Mar. 24; prod., U. S. in '86, June 30; mining, in Ill. Dec. 1; do. mach., Benson, Dec. 15; coke furnaces, Southern, Dec. 15; stocking and reloading, Dodge, Dec. 22-**7**.

" ECON. UTIL. OF, *Mech.* May 19; prod., U. S. '82, May 26; slack mach. Aug. 25-**3**; breaker, anthracite, Drifton, Pa. May 10, 24-**4**; anthra. and bitum., navy dept. rep. June; mach., Stand. Derrick Co. Sep; do. Bell, Nov; heating power of English, Kestner, Dec.-**5**; stocking and reloading, Dodge, Dec.-**7**.

" HAULAGE MACH. *Am. Eng.* Sep. 12-**4**; mines, anthra., growth of product, June 12; evap. power of coals, table, June 26; mine hoisting eng., Aulmann, July 30; anthra. tonnage in Penn., table, *Am. Eng.* files, middle of each month-**5**; U. S. prod. Feb. 25; anthra., U. S. Mar. 25, Apr. 22; do. in Penn. July 21, Aug. 18, Sep. 22, Oct. 20, Nov. 24, Dec. 22-**6**; U. S. prod. '86, Aug. 17; anthra. Penn. Dec. 21-**7**.

" EVAP. POWER OF, table, *San. Eng.* Feb. 19-**7**; mines, anthra., growth of capac. and prod. *Ry. Gaz.* May 29-**5**; pressing mach., Bietrix, July 16-**6**; prod. stat. July 8; trestles, Del. Lack. & West. R. July 22-**7**; preserv. from alteration on exposure to atmos., Poech, *Van. Nost.* Sep-**4**; combust. under press. Sep.-**5**; combust., heat of, Kestner, *Ry. & Eng.* Feb; U. S. prod., n. Mar; prod., Russia, Fay rep. Sep.-**7**; tar distil. *Fran. Inst.* Feb, Mar; tar constituents, Dec.-**6**.

" MINE, Zankerode, elec. locom. *Sci. Am. Sup.* Mar. 31; coke furnace, Seibel's, Apr. 21; recovery of volatile constituents, proc., Lightfoot, Aug. 25; mines, elec. in, Bagot, Sep. 15-**3**; breaker, Am. May 24; Pyke, July 26; chem. and valuation of, Glover, Nov. 8; coal-tar distil. ap. Nov. 22; anthra. fields of Penn., Ashburner, Nov. 22; incomplete combust. of gases, Dixon, Dec. 13; dust expts. near Neuwkerchen, Ger., W. Galloway, Dec. 20; coke ovens and by-product util., Hoffmann's, Dec. 27-**4**.

" STAITH, Butler's, *Sci. Am. Sup.* Jan. 10; origin and structure of, Mar. 21-**5**.

COAL, boring mach., *Sci. Am. Sup.* Jan. 30; cutting mach. and rope power, Bower, Feb. 13; mine fire-damp indic., Carleton's, Feb. 13; coke ovens, Aug. 7; mining, Sep. 25; Calvert, Nov. 27; coal-tar stm. vaporizer, Dec. 4-6; mine winding engs., Black Rock Coll. Apr. 16; combust. Oct. 22; coal-tar, saccharine product from, Fahlberg, Nov. 12-7.

" AM. COALS, character and effic., Shock, *Locom.* Jan; do. and evap. power, table, M. C. Meig's expts. May-3; waste, or culm util., Price, Dec.-4; authra. and bitum. compared, navy dept. rep. July; combust. Nov.-5; U. S. prod., '86, Ashburner, Aug.-7; coal-tar and colors derived from it, L. M. Norton, *Soc. Arts*, Dec. 11-4; mining, S. M. Buck, Mar. 10-7.

" DUTIES ON, England, *Eng.* Mar. 2; coke ovens, Sep. 21; do. manuf. Sep. 21; do. Jameson proc. Sep, 21, 28-3; coke ovens, Jameson, Jan. 11; coking and recovering by-products, Smith, Feb. 22; authra. breaker, Drifton, Pa. Feb. 22, Apr. 11; distil. expts. Apr. 11; and iron in '83, June 27; coke ovens and by-products, Sep. 26, Oct. 10, 17, 31-4.

" SPONTANEOUS COMBUSTION, *Eng.* Jan. 30; export, England, Feb. 6; supply, England, Feb. 13; tips, Butler, Inv's exhib. May 1; coke, Simon-Canes proc. May 29; blast furnace coke, value of, May 15, June 12, 19; coking, bye-products in, Watson Smith, June 19-5; dust fuel, July 9; gas tar burning, Oct. 29; dust explosions, Nov. 26; consumption, Cal., table, Dec. 10; and coke, sulphur in, Dec. 24-6; mining, in Col. Jan. 28; do. Belgian, Oct. 21; do. explosives for, Oct. 28; mine explosions, Tweddle, July 1; coke ovens, Bauer, Nov. 11-7.

" COKE OVENS, Jameson's, *The Eng.* Mar. 16; winding in deep shafts, Stokes, June 29, July 20, Aug. 10; colls., winding and pumping engs., Mariemont & Bascoup, Sep. 7-21-3; Doman mine, Hungary, Jan. 11; washing mach., Hall, Apr. 4, Aug. 8; wharf, Nine-elms, July 11; shipping mach., Westmacotts, July 25; English collieries, Aug. 22; recov. of bye-products, Watson Smith, Oct. 10; do. from Hoffmann coke ovens, Otto, Oct. 10; coke ovens, Hoffmann's regenerator, Oct. 10; staith, Butler's, Nov. 21-4.

" HYDR. HOIST., Boston docks, *The Eng.* Jan. 9; staiths, movable, Inv's exhib. May 22; districts of Ala., map, June 5, 19, July 3; washing mach., Sheppard's, June 5; loading mach., Rigg's, Inv's exhib. July 3; borer, Acme &c. Oct. 23-5.

COAL, coll. tank locom., Joicey, *The Eng.* Jan. 15; Brit. product, '85, n. Apr. 16-**6**; mine, and steel drum, Daglish, Mar. 11; calorific value of, Oct. 21, Nov. 4, 11-**7**.

COCKS, asbestos, *Eng. News*, Nov. 28-**5**; packed, *Mech.* Sep.-**5**.

COINS, value of foreign, *Eng. News*, Jan. 31-**5**; Am., curious facts about, *Iron Age*, Oct. 25-**3**.

COLOMBIA, U. S. trade with, *Iron Age*, Apr. 16; trade, Aug. 13-**5**.

COLOR GRINDING MACHINE, French, *Mech.* Nov. 24-**3**; tests, Harcourt, Greville, *Sci. Am. Sup.* Jan. 8-**7**.

COMBING MACHS., Thompson's, *Sci. Am. Sup.* Apr. 5-**4**; Heilman's cotton do., Dobson's imp. in, Mar. 21-**5**.

COMMODITIES, average prices of, for 40 years, Kimball, *Locom.* Apr.-**6**.

CONCRETE MIXER, Sooysmith, *Eng. News*, Dec. 6-**4**; Mar. 5-**7**; Caldwell, *St. Ry. Gaz.* June-**7**; Carey, *Eng.* July 3-**5**. See also CEMENTS.

CONSULAR reports, *The Eng.* files Jan.–Dec.-**7**, &c.

COOPER, PETER, por. *Iron Age*, Apr. 5-**3**; and first locom. *Ry. Gaz.* Apr. 13-**3**; por. *Elec. Rev.* Apr. 12-**3**.

CORK, mechan. properties, *Iron Age*, May 20; do. applic. of, Aug. 26-**6**; do. *Van Nost.* Oct.-**6**; do. *Nature*; W. Anderson, *Sci. Am. Sup.* Aug. 14-**6**; Feb. 12; and life saving applics. Apr. 23-**7**; manuf., Good, *Pop. Sci. M.* Sep.-**7**.

COTTON, crop, U. S. *Iron Age*, Sep. 13-**3**; compress, Sep. 18-**4**; *Ry. Gaz.* Sep. 24-**6**; Centen. expos., N. Orleans, *Fran. Inst.* June-**5**.

" MULE, self-acting, Lees, Oldham, *Sci. Am. Sup.* July 28-**3**; mills, waste in, July 25-**5**; do. *Wades F. & Fab*; spinning, Taylor, *Sci. Am. Sup.* Nov. 21; balling mach., Coates', Dec. 5-**5**; thread manuf., England, Aug. 6; opener, press and puller, Manchester exhib. Oct. 8-**7**; chem. of, *Soc. Arts*, Nov. 8-**3**; fibre, Pray, Apr. 10-**4**.

" TEXTILE MACH., Inv's exhib. *Eng.* June 5, 12; mills, Am. losses in hooping, etc. Aug. 21-**5**; explosions, Apr. 8-**7**; press, Morse's, *The Eng.* Apr. 17; baling press, Cummins', July 24-**5**; mach., Manchester exhib. June 17; press, comp. stm. and hydr., Egypt, Turner, June 24; carding, preparing, scutching and spinning mach., roving and slubbing frames and self-acting mules, in Manchester, Oct. 21-**7**.

" SEED OIL MANUF. *Eng.* July 10-**5**.

CRANES AND DERRICKS, boom derrick, *Eng. News*, Jan. 13, 20; 30 ft. hand derrick, Appleton, Mar. 10-**3**; 20-ton block setter, India, May 15-**6**; 100-ton floating, Atlas, Jan. 15-**7**.

" YALE, *Iron Age*, Feb. 15; do. 4-ton power walking, Mar. 8; 15 and 25-ton traveling, Box, May 3; Aug. 9, 16-**3**.

" WESTON-CAPEN, Yale, *Mech.* Feb. 10; 4-ton do. Mar. 10; trav., Box, Apr. 28; Towne, Aug. 4, 11-**3**; as labor saving machs., Appleby, Mar. 8; Dujour, Apr. 26; 60-ton, Rotterdam, May 3; Ridgeway, Oct.-**4**; 20-ton elec., Farcot, St. Owen, France, Sep.-**5**.

" TRAVELING, Walker's, *Am. Eng.* Apr. 4-**4**; trav. transfer, Lowe sys. May 27-**6**; trav. derrick, Equit. bu., N. Y. *San. Eng.* Jan. 22; derricks, builders and contractors eng. plant, Jan. 29; do. Croton aqued. Sep. 17-**7**; do. Court H., Boston, fall of, *Eng. & Bu. Rec.* Nov. 19-**7**.

" YALE, *Ry. Gaz.* Feb. 29; do. 6-ton hand trav. Feb. 29, Aug. 8-**4**; do. pillar yard, Mar. 25-**7**; French trav. *Ry. & Eng.* Oct-**7**; *Fran. Inst.* Aug.-**3**.

" DERRICK, 30-ft. hand, Appleton, *Sci. Am. Sup.* Apr. 14-**3**; construct. and use, Towne, Mar. 27; masonry, Nov. 1-**4**; 25-ton stm., Abouchoff steel wks., St. Petersburg, Apr. 18; 98-ft. Bonnet's, Dec. 26-**5**; elec. May 22; 10-ton stm. Goliah, T. Smith, des. Sep. 18-**6**.

" STEAM, 20-ton, Chaplin, *Eng.* Jan. 19; and traction eng. July 20; hydr., Bess. steel wks. Sep. 28-**3**; 60-ton, Rotterdam, Apr. 11; trav., Fielding, June 13-**4**; and grab, Coles, Inv's exhib. May 1-**5**; stm. trav., do. Sep. 17; 30-ton stm. coaling, Troon har. Apr. 2; 50-ton, Roker pier wks., Sunderland, Oct. 8-**6**; 15-ton floating, Buch, Apr. 1; 50-ton do., Tilbury docks, Hunter, Apr. 8; "all round" Titan, Ransomes, Sep. 16; 25-ton, Nov. 4-**7**.

" TRAVELING, 10-TON, Cape Town har. wks. *The Eng.* Jan. 26; power for dock estates, Maginnis, May 18-**3**; 40-ton hydr., Portsmouth dockyard, Jan. 4; 14-ton stm. portable, May 16; hydr. overside, Aug. 1; movable, Cardiff docks, Aug. 8; 150-ton, Abouchoff steel wks. Oct. 31, 31-**4**.

" HYDR., Buenos Ayres port, *The Eng.* Feb. 6; 35-ton stm., Abouchoff steel wks. Feb. 27; Wrightson's for Bess. casting pits, June 5; hydr. June 12; crab, overhead, Appleby's, June 26-**5**.

CRANES, 40-ton floating, Stettin har. *The Eng.* July 3; 15-ton forge, Abbott, eng. Sep. 4; Thwaite's hoisting and traversing, Oct. 23; stm. derrick and excav., Stothert, eng. Nov. 26; Rapier's pendulum titan, Nov. 13-**5**.

" HYDR., warehouse, *The Eng.* Sep. 24; do. Woolwich, Oct. 1; 50-ton floating, Tilbury dock, Oct. 29; 100-ton do., Armstrong, Dec. 3-**6**; traversing warehouse, Thwaite, Feb. 4; 20-ton floating, Appleby, Apr. 29; trav., Paris, Lyons & Med. Ry. Apr. 29, Sep. 9; 3-ton trav., 50 ft. span, Sep. 9-**7**.

CREAM, separating indus. in Scandinavia, *Eng.* Oct. 28; separators, centrif., Scand. Nov. 5, 18, Dec. 2-**7**; do. mechan. stm. and hand power, *The Eng.* Apr. 22; sep. mach., Victoria, Oct. 21-**7**.

CREGIER, DEWITT C., por. *St. Ry. Gaz.* Apr.-**6**.

CREMATORIUM, and furnace, at Buffalo, N. Y. *San. Eng.* Mar. 4; fur. for annual refuse, John Hopkins hos., Balt. July 15-**6**; crem., Lancaster, Feb. 26-**7**; at Wimborne Minstei, *Sci. Am. Sup.* Feb. 9-**4**.

CRICKET SCORER, Paget, *Eng.* July 29-**7**.

CRYPTOGRAPHY, *Eng. News*, Sep. 11, Oct. 2-**6**.

CUBA, *Iron Age*, July 9; and Spanish Col. July, Oct. 8-**5**; industries, Dec. 1-**7**.

CUBAN RECIPROCITY TREATY, *Iron Age*, Dec. 11-**4**; furnaces, Mar. 12-**5**.

CYPHERS, cryptography, Beaufort sys. *Eng. News*, Sep. 11; Oct. 2-**6**.

DAKOTA names, *Eng. News*, Sep. 22-**3**.

DAMS, masonry, of world, typical, *The Eng.* Mar. 11, 18-**7**; Carillon, Que., Ottawa r. and canal, Bell, *Eng. News*, Mar. 17-**3**; do. *Sci. Am. Sup.* May 12-**3**; Chagres dam, *Eng. News*, July 30-**7**; coffer, balanced floating, for water pipe repairing, Belmont main, Phil., Kinder, *Mech.* Oct.-**5**; construct., defective, *Eng. News*, June 6-**5**; Davis Is., Ohio r., Martin, May 15-**6**; do. *Sci. Am*; mud pond, E. Lee, Mass. *Eng. News*, May 8-**6**; Gileppe r., Verners, Belgium, Grugnola, Dec. 25-**6**; do. *Sci. Am. Sup.* Sep. 22-**3**; high masonry, computing strains in, Gould, *Van Nost.* Apr.-**4**.

" HOLYOKE, Mass. *Am. Eng.* Oct. 15-**5**; do. repairs to, *San. Eng.* Dec. 17-**5**; do. *Van Nost.* Apr.-**6**; do. *Eng.* Oct. 1-**6**; do. preserv. *The Eng.* May 14-**6**.

DAMS, Ingersoll, Ont., broken, *Eng. News*, Apr. 9-**7**; Kanawha r. Nov. 20-**6**; stone, Mechanicsville, N. Y. Oct. 18-**4**; Mittersheim reservoir, siphon weir of, Mar. 14-**5**; Montreal flood dykes, Oct. 1-**7**.

" QUAKER BRIDGE, Croton aqued., N.Y. water supply, specs. *Eng. News*, Apr. 12-**4**; Dec. 5-**5**; and reservoir, rep. Feb. 20, 27-**6**; Feb. 19, Mar. 5, Dec. 24-**7**; *Sci. Am. Sup.* Sep. 11-**6**.

" RESERVOIR, of world, Gravell, *Sci. Am. Sup.* May 28-**7**; do. *The Eng.* Mar. 11, 18-**7**; retaining, Wetzmann, Grueber, *Eng. News*, June 5-**6**. See also under names of do.

" SURESNES, at, *Sci. Am. Sup.* Dec. 13-**4**; Sweetwater, and irrig. experience in So. Cal. *San. Eng.* June 4-**7**.

" VILLAR MASONRY, Lozoya r., Manby, *San. Eng.* Mar. 15-**3**; do. *The Eng.* Apr. 13-**3**; Vyrnwy, do., Liverpool water supply, *Eng. News*, Jan. 30-**6**; do. *San. Eng.* Jan. 28, Dec. 25-**6**; do. *Eng.* Jan. 8-**6**; do. *The Eng.* Feb. 5, June 4-**6**; do. Jan. 7, 14, 28-**7**.

DECORATION, Garesche, *Sci. Am. Sup.* June 18-**7**.

DENNY, WM., por. *Sci. Am. Sup.* Apr. 30-**7**.

DEPREZ, MARCEL, por. *Sci. Am. Sup.* June 16-**3**.

DEVEREUX, JOHN, por. *Ry. Gaz.* Apr. 2-**6**.

DIAMONDS, So. Africa, *Iron Age*, May 28-**5**.

DISTILLING AP., Egrot's, *Sci. Am. Sup.* Aug. 2-**4**.

DOCKS. See HARBOR ENG.

DOOR SPRING, hydr., Stevens, *Eng.* Mar. 6-**5**.

DRAINAGE, of valley of Mex., Garay, *Eng. News*, July 7-**3**; drains, ordinary, Norwich, Conn. Aug. 15; h., Coney Is. Sep. 19, Oct. 3; in Ill. Dec. 19-**5**; Boston, Jan. 16; do. Mystic r. valley, rep. Jan. 23; canals, Ill. Feb. 20; and ventil., h., De Vinne Press, Mar 6; tile and open ditch drains, capac. of, I. O. Baker, Sep. 4; Ill. Oct. 30; City of Mexico, Nov. 6-**6**; of valley and City of Mexico, July 16-**7**.

" LAND, engs. for, *Iron Age*, Mar. 24; pump, screw, Dutch, May 19; of fens and lowlands by stm. power, Wheeler, June 23; scoop-wheels, Deeping Fen, England, Aug. 25-**7**.

" POND, Fort, expts., So. West Ga. *Mech.* Aug.-**4**; Boston main, wks. Dec.-**5**; of large marshes, Hollister, *Am. Eng.* Feb. 1-**4**; agric., Hartford, Feb. 27-**5**; U. S. Mar. 9, 16-**7**; of large marshes, Hollister, *Van Nost.* Oct.-**4**; Commission, Mass., rep. May; mach., Po valley, n. June-**6**.

DRAINAGE, of large marshes, Hollister, *Sci. Am. Sup.* Mar. 22-**4**; in Ill. Jan. 23; reclamation of lake Copais, Aug. 21-**6**; pump, Dutch screw, June 4; imp. of fen districts by scouring, dredgers and water transport. power, W. H. Wheeler, Dec. 17-**7**.

" SLUICES, Lough Erne wks. *Eng.* Sep. 19-**4**; of H. of Parliament, Shone, Feb. 4; arterial, in Ire. June 10-**7**; sluices, Lough Erne, *The Eng.* Sep. 19, sup. Oct. 10, 10-**4**; reclam. of L. Copais, July 9-**6**; of H. of Parliament, Feb. 4; of fens and low lands by stm. power, Wheeler, Feb. 4-18, Mar. 4, 25, Apr. 8, 15, June 3, 17, Nov. 18; wks., Ballyteigne, Ire. Apr. 29; do. Newhaven, July 29; of fens, etc. Aug. 5, Sep. 2, Oct. 7, 21, 28-**7**.

DRAPER, HENRY, *Sci. Am. Sup.* Mar. 10; por. Apr. 7-**3**.

DRAWING FRAME, rotary (fibre) *Sci. Am. Sup.* Oct. 23-**6**.

DRAWING, reproduction, blue print proc. *Eng. News*, May 5; preserv. sys., O. Smith, Aug. 4-**3**; India ink, Apr. 5; map, photo-copying, Min. of Pub. wks., France, June 28; conventional colors, Haupt, July 5; blue and black proc. reprod. Aug. 9, 30; So. West Ga., Fort, Nov. 1-**4**.

" RULER, adjust. curve, *Eng. News*, Mar. 28; mach. topog. Aug. 22; print proc. on white ground, Shancross, Haig, Nov. 28-**5**; reprod. heliography, or actinic copying, Thwaite, Nov. 27; for reprod. (electrotype proc.) Dec. 11; reprod. black proc. Dec. 25-**6**; bd. and blue print frame, Feb. 19; map reduction, photographic, Apr. 2; pantagraph, Gieseler, Nov. 26; standard section lining, Van Vleck, Dec. 31-**7**.

" REPROD., printing on white ground, *Iron Age*, Nov. 19-**5**; black proc. do. June 10-**6**; office, blue print file, *Mech.* May 5; blue proc. June 23; reversed do. Sep. 22; instruments, Gardam, Oct. 20; photo. reprod. of, Townsend, Oct. 27, Nov. 10, 17-**3**; office sys., Towne, Jan. 28, July; Bergner, Dec.-**4**; duplicating, n. Richards, Nov.-**5**; blue prints, July, Oct.-**6**; standard section lining, Van Vleck, Dec.-**7**.

" WORKSHOP, Ottewell, *Am. Eng.* Nov. 7, 21-**4**; instruments, comeograph (ellipse dr. &c.), Campbell, Dec. 1-**6**; black proc. reprod. Mar. 16-**7**; mechan. *Ry. Gaz.* Feb. 23-**3**; black on white ground proc. Nov. 6-**5**; paper clip, May 21-**6**; draughtsmen, Mar. 11; blue proc. reprod. July 8-**7**; ellipsograph, *Fran. Inst.* Oct.-**6**; school, Fran. Inst. rep. June-**7**.

DRAWING, LARGE BLUE PRINT AP., Parsons, *Sci. Am. Sup.* Jan. 26; pantograph and beam compass, MacCord, Feb. 16; reprod. by elec. ap., Schmid's, Nov. 8-**4**; map and plan copying, blue proc. etc. Jan. 24; instrum. for ellipses and hypers., Honey, May 23; blue lines proc. Haig, Nov. 7; do. R. W. Jones, Nov. 7; curve instrum., MacCord, Feb. 27, Apr. 3; ellipses, Aug. 7-**6**; instrum. for curves, Jan. 1; blue pr. copying, etc. Feb. 19; do. Mar. 19; actinic heliography, Thwaite, Mar. 12-**7**; do. *The Eng.* Dec. 17, 24-**6**; blue proc. formulas, *Locom.* Jan.-**5**; motion, Batchelor, *Eng.* July 4-**4**.

DREDGING MACH., "Hercules," Pan. canal, *Eng. News*, Feb. 3-**3**; on the Tees, Fowler, Apr. 5; marine, Pan. Canal Co. Apr. 5; suspended, Hall, Aug. 2; bucket, Both, Aug. 2; Coney Is., N. Y. Dec. 6-**4**; Bruce, Jan 24; Atlas, Jan. 31-**5**; ap. for shaft sinking, Mar. 6; dumping scow, Barney, Mar. 20; Flood rock, Mar. 20, June 19; Robinson, Dec. 4; and excav., single-chain, Jessop, Dec. 11-**6**; self penetrating grapple, Feb. 19; appliances, Webster, July 16, 23-**7**.

" RECENT IMPS. IN, *Iron Age*, Dec. 16-**6**; operations and appliances, Webster, Mar. 31, and excav. hoisting and conveying mach., Brown, Apr. 28-**7**; Oakland har., Cal. *Mech.* May 24-**4**; Osgood excav. *Am. Eng.* Feb. 27-**5**; Badger pumping, Jan. 28-**6**; Jessop's single-chain excav. Jan. 12; hydr., Hunt, Aug. 3-**7**; builder's and contractor's eng. plant, imps. *San. Eng.* Dec. 25-**6**; dumping scows. Jan. 1-**7**; Potomac flats plant, *Eng. & Bu. Rec.* Oct. 8; Lockwood, Cape Cod Canal, Nov. 5-**7**; Dunbar, *Ry. Gaz.* Nov. 13; Osgood, Nov. 20; stm. excavs., Am. and English, Dec. 25-**5**; for Suez canal, Nov. 4-**7**.

" MEINESZ'S COMP. AIR AP. *Sci. Am. Sup.* Mar. 22; marine, for port of Colon, Apr. 5-**4**; Gabert's revolving excav. Jan. 31; Am., on Pan. canal, Feb. 14; Osgood mammoth excav. Apr. 11; Am. Spoon & Hercules, July 18-**5**; Demange's excav. Feb. 13; Jacquelin do. Sep. 18-**6**; Gatmell do. Aug. 6-**7**.

" WEAR R. comp. engs. and boilers, *Eng.* Jan. 12, 26, Feb. 23, Mar. 16; r. and canal, Priestman, Feb. 16; Smith's hydr. Aug. 10; twin screw, Nov. 23-**3**; Hall's suspended, July 4; ops., Oakland har., Cal. July 11-**4**; Powell's mud receiver and hydr. lift, Jan. 2; hydr., Burmah, Bruce sys. June 12; Dunbar stm. navvy, Ruston, Aug. 21, 28-**5**.

DREDGING MACH., twin screw, New Zeal. *Eng.* June 11; Royal Albert docks, Aug. 13-**6**; Jan. 7; stm. excav., Osgood Dredge Co. Feb. 11; excav., Gatmell, Feb. 18; Webster, Mar. 4; twin screw hopper "Pholas," Bombay, June 24; on Clyde r., C. A. Stephenson, Aug. 12, Sep. 9-**7**.

" GRAB-BUCKET, Priestman, eng. *The Eng.* Feb. 9; Sep. 21; Smith's hydr. Nov. 23-**3**; excavs., Pan. canal, Weyher, eng. July 11-**4**; Melbourne har., sup. Oct. 16, 30, Nov. 13, 20, 20-**5**; Priestman's, for Brazil, Sep. 10-**6**; Osgood excav. Jan. 7; Bristol, Jan. 7; engs. commission, "Dolphin," Jan. 14, 21; and dredging lower estuary Clyde, C. A. Stephenson, Aug. 12; Harrison's scouring, for fen drains and rivers, Oct. 28-**7**.

DRILLS, rock, Brandt, *Eng. News*, Feb. 9-**4**; press., Eberhardt, *Mech.* Jan.-**6**; rock, Halsey, *Am. Eng.* Nov. 21-**4**; radial, Jan. 19-**7**; multiple, *The Eng.* Nov. 21-**4**; hydr., Stevenson's, May 13-**7**. See also MINING.

DRILLING MACHS., for Russian gov. *Iron Age*, Dec. 27-**3**; multiple, Feb. 3; hydr. portable, Toulon, France, Mar. 31-**7**; and slotting mach. *Mech.* July 28, Aug. 11; do. Bement, Sep. 8; Russian, Dec. 1-**3**; twist grinder, F. Smith, Feb. 2-**4**; portable hydr., Toulon dock-yard, Fontaine, *Eng.* Feb. 11-**7**; hydr., Fontaine, *The Eng.* May 6-**7**.

DRYING MACHS., removal of steam from, Blackman vapor propeller, *Sci. Am. Sup.* Dec. 18-**6**; kiln for cereal products, Tomkins, *Eng.* Oct. 24-**4**.

DUST, explosions, *Eng. News*, Nov. 7-**5**; do. Abel, *Sci. Am. Sup.* Mar. 3, 10-**3**; and ashes, Fryer, *San. Eng.* July 9-**7**.

DYEING, colors, effect of light and soap on, *Sci. Am. Sup.* Nov. 6-**6**; garment, Mar. 26-**7**. See also CHEMISTRY, DYEING.

DYNAMOMETERS, portable, Wale's, *Iron Age*, Aug. 7-**4**; Raffard, Feb. 18; valve, Giddings, June 17-**6**; Ayrton, *Mech.* Feb. 10; balance, S. S. Webber, June 30; White, Durfee, Aug. 4-**3**; Puplus, Paris, Mar. 29, Apr; Rieter, July; portable, Wale's, Oct.-**4**; Webber's balance, Aug.-**6**; traction, Fitch, Sep.-**7**; Tatham, *Fran. Inst.* Nov, Dec.-**5**; do. Nov.-**6**.

" WHITE, *Electric.* Nov.-**5**; Tatham, *Elec. Rev.* July 26-**4**; do. Dec. 12-**5**; balance, Lawrence mach. Aug. 21-**6**; Webb's elec. *Elec. World*, Sep. 10, 17-**7**; Ayrton's, *Sci. Am. Sup.* Feb. 17; Megy's totalizing, Mar. 17-**3**.

DYNAMOMETERS, Puplus', *Sci. Am. Sup.* May 10; brake, Bear's, July 12-**4**; belt, Hefner des. Dec. 4-**6**; Silver & Gay and Ruddick recording, 2 forms of, Hollerith, *Soc. Arts*, Nov. 3-**2**.

" TATHAM, *Eng.* June 27-**4**; for cable laying, Lacoine, Feb. 13-**5**; registering belt, Ganz, Sep. 10-**6**; flex. band, Unwin, *The Eng.* Oct. 19-**3**; Bailey's power testing ap. Mar. 21; brake, Bear's, June 6-**4**; Tatham's, Dec. 25-**5**.

EADS, JAMES B., por. *Eng. News*, Apr. 16-**7**; do. *Mech.* Apr.-**7**; do. *Ry. Gaz.* Mar. 18-**7**; *Ry. & Eng.* Apr.-**7**; por. *Sci. Am. Sup.* May 7-**7**; *Eng.* Mar. 18-**7**.

EARTH, figure of, *Eng. News*, Feb. 24-**3**; age, Proctor, n. Aug. 30, mean temp. of world, Nov. 22-**4**; underground temps. Dec. 19-**5**; density, Sep. 10-**7**; temp., n. *Mech.* Nov.-**5**; do. underground, *Van Nost.* Apr, May-**3**; do. *Nature*; rotation, deflective effect of, Davis, *Van Nost.* Apr; deflections, Randolph, June, Dec.-**3**; rotation, effect of on bodies moving on surface, Oct.-**3**; figure of, Roberts, Mar.-**5**.

" TERRESTRIAL RADIATION, J. Tyndall, *Sci. Am. Sup.* Apr. 28; movements in Java, R. Proctor, Dec. 22-**3**; do. Feb. 9-**4**; mass. secular inc. of, Winchell, May 3; temp. in deep mines, H. Smith, Sep. 20-**4**; temp., mean, secular dec. of, Hiscox, Feb. 21; mean density det. June 6; Grotto of Gargas, Sep. 26; underground temps., Prestwich, Nov. 28-**5**; do, Feb. 13-**6**; do. *The Eng.* Nov. 6-**5**; currents, Wernstein, *Sci. Am. Sup.* June 19-**6**; pop. *Locom.* July-**3**.

EARTHQUAKE, Seismological Soc. of Japan, *Am. Eng.* Jan. 16-30-**5**; elec. seisoscope clock, *Elec. World*, Mar. 12; Ewing's seismographs, July 9-**7**; Gray's recorder, *Sci. Am. Sup.* Aug. 23-**4**; in Andalusia, May 2; seismograph, Cordenon's indic. May 9; Oct. 24-**5**; earthquakes, R. Thayer, Nov. 6-**6**; do. McGee, Jan. 15-**7**; earthquake in Essex, *The Eng.* May 2-**4**.

EDUCATION, civil service exams., N.Y. munic. *Eng. News*, Aug. 7; French eng. school, L'ecole des Ponts et Chaussees, Aug. 14-**6**; in civil eng., Waddell, Jan. 8; do. discuss. Jan. 22-**7**; tech. Cunynghame, *Van Nost.* Aug.-**5**; do. Sibley Coll. Jan.-**6**; the nation's great prob., Thurston, Oct.-**6**; tech. *Fran. Inst.* Nov.-**3**; ed. ap., rep. Mar.-**6**; eng. course in tech. schools, Hutton, *Elec. Rev.* Nov. 26-**7**.

EDUCATION, HUXLEY, *Sci. Am. Sup.* Apr. 21-**3**; tech., in Am. July 19; natural sci. in schools, H. E. Armstrong, Dec. 20-**4**; of engineers, Thurston, Sep. 18; in handicraft, Dec, 11-**6**; on continent, Arnold, Feb. 12; tech. training, Thurston, July 16-**7**; illus. in Nuemberg Indus. exhib., Ordway, *Soc. Arts*, Feb. 8-**3**.

EGYPTIAN CIVILIZATION, early, Selikovitsch, *Fran. Inst.* May-**7**.

ELECTRIC SERVICE CO., air pump, *Elec. Rev.* Nov. 20-**6**.

" ANNUNCIATORS, and fire alarm, Van. Benschoten's, *Elec. World*, May 24-**4**.

" APPARATUS, Gramme mach., storage bat., dynamoes, ampere meter, Holtz mach., elec. lamps, *Fran. Inst.* Mar.-**6**; in submarine mines, H. L. Abbott, rep. *Elec. Rev.* Oct. 4-**3**.

" ART, *Fran. Inst.* May; art applics., rep. May; in U. S. pat. office, May-**6**; do. hist., Kintner, *Elec. World*, May 15, 22-**6**; do. do. *Sci. Am. Sup.* June 5-**6**.

" BALANCES, W. Thomson, *Electric.* Nov.-**7**.

" BATTERIES. See also ELEC. STORAGE BATTERIES.

" BATTERIES, galvanic, cellulose for, Beehler, *Mech.* Aug.-**7**; Bunsen cells, elec. mo. force and resist., Grower, *Van Nost.* Dec.-**3**; primary, *Ry. & Eng.* Oct.-**7**; and Fritts' selenium cells, *Fran. Inst.* Mar; rep. Apr.-**5**.

" BATTERIES, Copperoxide, Lalande, *Electric.* Sep.-**3**; det. of elec. mo. force and internal resist. of, Hooper, Aug; rotative, Bazin, Sep.-**5**; voltaic action, theory of, J. Brown, Feb; reversible lead, and use for lighting, Fitz-gerald, May, July; medical, Piper, Aug.-**7**.

" BATTERIES, Daniel cell, corrosion of copper plate in, *Elec. Rev.* Apr. 5; galvanic, Sep. 13-**3**; Daniel, elec. mo. force, Apr. 10; medical, July 19, 26-**4**; and Fritts' selenium cells, Feb. 14; Bazin's rotating, Aug. 15; galvanic, Van der Weyde, Dec. 26-**5**; Lathrop plunge, May 15; acid gravity, July 31; resist. galv., Farmer, Sep. 11; C & C motor, Nov. 13-**6**; chromic compounds, Apr. 9; chloride of silver, Barrett, Dec. 10-**7**.

" BATTERIES, Lalande-Chaperon, *Elec. World*, June 21-**4**; tests, Apr. 18; Bazin's rotative, Hospitalier, Aug. 22-**5**; running down of, as influenced by performance of mechan. wk., Lodge, Apr. 24; relative working value of bat. materials, Fitch, May 8; "Upward" gas, for domestic lighting, July 17; open circuit, meths. of preventing deterioration of, Bogart, Aug. 7; Roberts' dry, Aug. 14-**7**.

ELECTRIC BATTERIES, Lithanode, D. Fitz-Gerald, *Elec. World*, Oct. 2; peroxide, I. L. Roberts, Oct. 9-**6**; elec. mo. force of, cals., Tommasi, Apr. 16-**7**.

" BATTERIES, Nitric and Chromic acid, J. T. Sprague, *Sci. Am. Sup.* Apr. 21; insulite sealed, June 23-**3**; cost of, Jan. 19; selenium pile elements manuf. Nov. 8; gas carbon, Franks, Nov. 15-**4**; Fritts' selenium cells, June 6; Bazin's rotary pile, Oct. 10-**5**; expts. towards the animal bat. Aug. 28; Upward primary, Sep. 11-**6**; cellulose, Jan. 29-**7**.

" BATTERIES, Paris Elec. exhib. *Eng.* Apr. 3; and Fritts' selenium cells, Apr. 17-**5**; thermal, Aug. 13-**6**; water, June 24-**7**; currents, cost, *The Eng.* Nov. 30-**3**; running down of, Lodge, Feb. 5; fall of elec. mo. force with discharge, Higgs, Mar. 5; Lithanode, Fitz-Gerald, Oct. 29-**6**; for carbon consumption, Sep. 30-**7**.

" BATON, Carpentier, *Eng.* Jan. 14-**7**.

" BLEACHING, textile fabrics of veget. fibre, *Electric.* July-**3**; Naudin, *Sci. Am. Sup.* Nov. 10-**3**; proc. Sep. 25-**6**.

" BOAT, Vienna Elec. exhib. *Mech.* Nov. 24-**3**; stm. launch, "Electricity," *Van Nost.* May-**3**; do. Reckenzaun, May-**4**; Trouve, *Elec. Rev.* Apr. 26-**3**; do. Feb. 19-**7**; submarine, Goubet, June 19-**6**; launch, *Eng.* July 20-**3**.

" BRAKE, Ries', *Elec. World*, Mar. 5-**7**.

" BRICKS, generative, *Electric.* Feb.-**3**.

" BRUSH contact and comp. switches, Hartwell, *Eng.* Oct. 21-**7**.

" CHEMICAL EQUIVS., table, Prescott, *Electric.* Jan.-**6**.

" CHRONOMETER for measuring speed of nervous impressions, D'Arsonval, *Elec. World*, July 23-**7**.

" CIRCUITS, inductive and conductive, Sprague, *Van Nost.* Mar.-**3**; do. *Electric*; divided, Arey, *Electric.* Dec.-**5**.

" CLOCKS. See CLOCKS.

" CLUB, N.Y., pro. *Elec. Rev.* Feb. 12; discuss., expts., Eickemeyer, Mar. 12; pro. Apr. 30-**7**.

" COLOR making and fixing, Hummell, *Elec. Rev.* Aug. 15-**5**.

" COMMUNICATION without wires, Dolbear, *Electric.* Nov.-**6**; do. *Sci. Am. Sup.* Dec. 11-**6**.

" CONDUCTIVITY OF METALS, *Iron Age*, Nov. 19-**5**; tests, Weiller, May 12-**7**; table, *Mech.* May-**7**; do. Weiller, *Van Nost.* Oct.-**5**; and alloys, table, do. *Electric.* Dec.-**4**.

ELECTRIC CONDUCTORS, econ. size of, *Am. Eng.* Nov. 7-**4**; Preece, *Van. Nost.* Jan, July, Aug.-**4**; most econ. size, Hooper, *Electric.* July-**4**; overhead, hard-drawn copper wire as a, Maver, May-**5**; sizes of, Hering, Feb; ærial, heating by elec. currents, J. G. White, Aug, Oct, Nov; proportioning, Turner, Nov.-**6**; lead encased, D. Brooks, Jun.-**7**.

" CONDUCTORS, wires, rep. *Fran. Inst.* Nov.-**5**; manuf., *Elec. Rev.* Aug. 23-**3**; most econ. size, June 14-**4**; profitable section for power trans., Rae, *Elec. World*, Dec. 19-**5**; lead-cased, *Sci. Am. Sup.* May 26-**3**; Joel's meth. of laying, *Eng.* Aug. 10; Dec. 14-**3**; Preece, *The Eng.* Dec. 14-**3**; sectional area diagram, sup. Nov. 21, 21-**4**.

" CONFERENCE, Nat. pro. *Electric.* Oct.-**5**; *Elec. World*, Sep. 13-**7**; congresses of past, Oct. 4–25, Nov. 1, 8, 29-**4**; do. Phila. *Sci. Am. Sup.* Oct. 18-**4**.

" CONVERTER, Brown aut. *Elec. Rev.* Mar. 13-**6**.

" CONVEYORS, and Lartigue's light elec. Rys. *Sci. Am. Sup.* Nov. 22-**4**.

" CURRENTS, *Eng. News*, Feb. 10-**3**; induction between wires, Preece, Dec. 18-**6**; and poten. indics., Kapp, *Mech.* May 17-**4**; inc. of adhesion by, Ries, *Ry. Gaz.* Aug. 19-**7**; induced, in a magnetic field, Murdock, *Van Nost.* July-**3**; personal safety with, Dolbear, Feb.-**5**; self-induction and conductors, Hughes, July-**6**; traction adhesion for varying, Ries, *Ry. & Eng.* Sep.-**7**.

" CURRENTS, energy of, Carhart, *Electric.* Aug.-**4**; measuring by galv. Hering, Jan.-**5**; measurement, Hospitalier, Mar; self-induction, Hughes, Apr, June–Aug; alternating, Deri, Sep.-**6**; alternating ap., power absorbed by, Jan; self-induction, coeff. May; alternating, distrib. by, Kennedy, May, July, Aug; do. E. Thomson, June; do. Slattery, Sep; do. Stanley, Sep; do. max. wk. of, Kapp, Oct; induction between wires, Preece, Nov.-**7**.

" CURRENTS, induction in cores, Heaviside, *Elec. Rev.* Aug. 9-**4**; protector, standard, Aug. 1-**5**; self-induction, Gerard, Apr. 2, 23; alternating, E. Thomson, June 4; do. disk galv., Fleming, June 11; dangers to life, Badt, Aug. 27; multiple arc distrib., Edison, Sep. 10-**7**.

" CURRENTS, magnetic, rotation of in metals etc. Hall, *Elec. World*, Nov. 8, 29; personal safety with, Dolbear, Nov. 29-**4**.

ELECTRIC CURRENTS, self-induction, Hughes, *Elec. World*, Feb. 27, Mar. 6–27, July 3–17, 31, Aug. 14; divided, inc. in branches of, expt., Rayleigh, Oct. 16; reg., Brush's, Nov. 20-**6**; constant, with varying elec. mo. force, Trotter, Sep. 24-**7**.

" CURRENTS, fatal power of, *Sci. Am. Sup.* Apr. 19-**4**; voltaic, gen. by sulphur cell with solid electrolyte, Bidwell, Dec. 12-**5**; self-induction, Hughes, Apr. 3, Jnly 24-**6**; alternating, E. Thomson, July 9; Foucault's ap. for illus., Waltenhofen, Aug. 6-**7**.

" CURRENTS, induction, Volta, *Eng.* Nov. 16-**3**; and poten. indics., Kapp, Feb. 29-**4**; self-induction, Hughes, Feb. 5, Apr. 23, June 11-**6**; measuring instrums., Crompton and Kapp, *The Eng.* Feb. 22; aut. reversing commutator, Volk's, Mar. 28; alternating, theory of, Hopkinson, Dec. 5, 12-**4**.

" CURRENTS, transformers, continuous, *Electric.* Feb; Gaulard, effic. tests, Cardew, Aug; sub-divided, Gutmann, Oct.-**7**; Hospitalier, *Elcc. Rev.* Sep. 20-**4**; distrib. by, Dec. 25-**6**; secondary, Benjamin, Feb. 5, 12; effic., Zipernowski, Apr. 16; alternating, distrib. by, Kennedy, May 7; regulating series-wound, May 21; do. E. Thomson, June 4; distrib., Edison sys. Oct. 1; Jehl, Nov. 19; Paris and Scott, Nov. 19-**7**; high and low tension, Bollmann's meth. *Elec. World*, July 9-**7**; distrib. by, *Eng.* Oct. 14-**7**; Edison sys. *The Eng.* Nov. 4-**7**.

" DISCHARGES, Mareschal, *Elec. World*, Feb. 28-**5**; through gases, expts., Schuster, Sep. 17-**7**; and spark photographs, *Sci. Am. Sup.* Apr. 4-**5**.

" DISINTEGRATOR, *The Eng.* Sep. 23-**7**.

" DISTRIBUTION, Edison's 3-wire sys. *Am. Eng.* Dec. 5-**4**; Forbes, *Van Nost.* Apr; June-**6**; Gaulard sys. *Ry. & Eng.* Jan.-**7**; by alternate currents, bk. n., Kennedy, *Fran. Inst.* Sep.-**7**.

" DISTRIB., Edison 3-wire sys., Paul, *Electric.* Mar; Forbes, May–July-**5**; do. Apr; Westinghouse, Gaulard pat. Dec.-**6**; Gaulard and Gibbs sys. *Eng.* Mar. 2-**3**; do. *Elec. World*, Dec. 4-**6**; by storage bats. Feb. 7-**5**; by alternating currents and transformers, Kennedy, May 14; econ., Webb, June 18; Edison sys. July 23-**7**; by induction, Enuma, *Sci. Am. Sup.* Sep. 20-**4**; sys., E. Thomson, July 23-**7**; by aid of induction coils, Slattery. *Soc. Arts*, May 26; imps. in, Stanley, Dec. 22-**7**. See also ELEC. CURRENT, TRANSFORMERS.

ELECTRIC, DEPOSITION OF ALLOYS, expts., Watt, *Electric.* Oct.-**7**.

" DRILL, rock, Phelps, *Elec. Rev.* July 23-**7**.

" DYNAMICS, *Electric.* Aug; dynamic theory, P. Atkinson, Sep.-**3**.

" DYNAMOS, Gordon, Jan. 11-**3**; mammoth Brush, Sep. 2-**6**; Ferranti, *Mech.* Jan. 6; small, Meritens, Jan. 20; motor reversing gear, Oct. 6-**3**; Ferranti, Feb. 2; Gramme multipolar, Apr. 19; generator, Ganz, June 14; and eng., Budapesth, June 14; mach. testing, Sep.-**4**; effic. Nov.-**5**; Daft motor, N. Y. Elevated Ry. *Ry. Gaz.* Nov. 27-**5**; Thompson, *Van Nost.* Mar, Apr.-**3**; do. May, June-**4**; and magnets, n. Feb.-**5**; motors, effic. *Ry. & Eng.* Jan; do. J. F. Sprague, May-**7**.

" DYNAMOS, Tatham, Edison, Weston, tests, rep. *Fran. Inst.* Nov.-**5**; great Brush, Oct; tests, Dec.-**6**; motors, Sprague, *St. Ry. Gaz.* Aug.-**7**.

" DYNAMOS, Ferranti mach. *Electric.* Mar; Ball unipolar, May; Nov, Dec; Fiske, Dec; effic., Hering, Dec.-**3**; action of, Fiske, Jan; Edison tests, Cincin. Apr; mach., Tœpler expts., P. Atkinson, May, Dec; as a motor, J. V. Meigs, Dec.-**4**.

" DYNAMOS, motor construction, Chaster, *Electric.* Jan, Feb, Apr, Aug; comp. Feb; Ball unipolar, tests, Raymond, Feb; dyn. electrotyping, Apr; Edison, test, Apr; Bollmann, Gruninger, June; governing pulley, Campbell, July machs., theory of, Asher, Aug; best form, Sperry, Sep.; armatures, cyl., Hering, Nov; machs., tests, rep. Fran. Inst. Committee, Dec.-**5**; do. Jan-**6**.

" DYNAMOS, mach. tests, Heinrichs, *Electric.* Feb; armatures, cyl., Hering, Mar; as a gen. and motor, Mordey, Apr; building, May–July; small, tests, Anthony, rep. May; mach. testing, effic. of, Kapp, Aug; mach., copper dep. by, Floyd, Aug; tests, Fran. Inst., Hering, Nov; great Brush, Thurston, Dec.**6**.

" DYNAMOS, Hopkinson mach. *Electric.* Jan, Feb; "dead wire," Anthony, Feb; do. Hering, May; C & C motor, Feb; motors, F. J. Sprague, Mar; do. Baxter, Mar; do. small, requirements of, Wheeler, Mar; do. do. effic. of, Clifford, June; tests, Jackson, Apr, June; Gramme armamature and field iron, Jackson, June-**7**.

ELECTRIC DYNAMOS, magnetic fields, C. Hering, *Electric.* Aug; do. magnetism of iron in, Ewing, Oct; mach. construction, W. Adams, Dec.-7.

" DYNAMOS, Ball unipolar mach. *Elec. Rev.* Apr. 26, May 17, 17; machs., preduducial action, Geraldy, May 24; do. parasitic action in, May 31; Ferranti, Sep. 20; motors, Oct. 4; Gramme, Fuller Co. Dec. 6, 13; hand power, Dec. 6-3; Brush, Jan. 10; for electro-plating, Colburn, July 12; McTighe, Aug. 30; machs. as substitute for telegraph bats., Rothen, Sep. 6; Gerard, and incand. lamps, Sep. 27; Victoria, Anglo-Am. Co. Oct. 4; 20-light, Remington, Dec. 6-4.

" DYNAMOS, Colburn, *Elec. Rev.* Feb. 14; Edison-Hopkinson, test, Feb. 21; Bolimann, May 16; best form, Sperry, Aug. 29; Mather, and incand. lamp, Oct. 17; Zipernowsky, Nov. 14; Fran. Inst. effic. tests, Nov. 14, 28-5; Knowles-Moffat, Jan. 16; Thomson incand. Feb. 6; motors, Chaster, Apr. 11; Western Co. July 17; Gordon, Aug. 7; Brooklyn Elec. Construct. Co. Sep. 4; power trans. to, Pentz, Sep. 18; Brush motor, Sep. 18; Gramme ring, hist., Van der Weyde, Oct. 23; Immisch motor, Dec. 4; testing, Dec. 25-6.

" DYNAMOS, motor gov., Ayrton, *Elec. Rev.* Jan. 8; Kennedy, Feb. 5; motors gov., Mordey, Feb. 5; Deprez, Feb. 5; iron clad, Apr. 9; and ap., Am. sys. Apr. 23; Brown, May 7; 8-light, Hopkins, June 11; motor, Baxter, June 11; driving gear, Ayrton, July 30; Siemens-Halske, Aug. 13; field magnets, Nov. 5; constant current, Nov. 12; C & C motor, Dec. 3; friction driving gear, Dec. 17; steam turbine, Clarke, Dec. 31-7.

" DYNAMOS, mach., Edwards, *Elec. World*, May 3; alternating-current, May 31; Daft, Aug. 23; Oppermann, Sep. 6; Brush, Sep. 20; Sawyer-Man, Oct. 25; Gerard, and lamps, Oct. 25; motor, Reckenzaun's, at Elec. exhib. Nov. 15; machs., expired pats. on, Brock, Nov. 29, Dec. 13; mach., Forbes, Dec. 6-20-4.

" DYNAMOS, motor pats., expiring, Brock, *Elec. World*, Jan. 10, 24, Feb. 14, Mar. 7; Thomson-Houston, Mar. 28; English, Apr. 4; Western Co's, Apr. 11; Daft motor, May 16; Sperry sys., Aug. 22; best form of, Sperry, Aug. 29; Schuyler sys., Sep. 5; Crompton-Burgin, Sep. 12; Wood-Gramme, and current reg. Oct, 17-6.

ELECTRIC DYNAMOS, testing ap., Phil. and Fran. Inst. tests, *Elec. World*, Nov. 14, 21; Deprez motor, Dec. 5; Brooklyn Elec. Construct. Co. Dec. 12; Zipenowsky-Deris, Dec. 19; Edison and Weston compet. tests, Dec. 19-5; do. Mar. 20-6.

" DYNAMOS, Heinrich's, *Elec. World*, Jan. 2; Bain's, Feb. 6; field magnets, 20 typical forms, Feb. 13; as generator and motor, Mordey, Feb. 13; Thomas', Mar. 13; Hochausen's, Mar. 27; Westinghouse, Apr. 3; magnet winding for shunt, series and comp. machs. Apr. 10, 17, May 1, 15; testing, Hopkinson meth. Apr. 17; Fran. Inst. tests, Duncan, Apr. 17; and gas eng. combined, Apr. 24-7.

" DYNAMOS, Jenney, *Elec. World*, May 8, Wenstrom, May 8; Hecla, May 15; motors, early expts., Van der Weyde, May 22; Daft motors, May 22; construct., Gravier, June 12; Joel's, July 10; Cowle's elec. smelting, Aug. 21, 28; transmission of power to, Pentz, Sep. 25; armature winding, Frige, Oct. 9; motor, Stockwell, Oct. 16; motors, Sprague sys. Oct. 16, 30; Clark's, Nov. 6; Edgerton's, Nov. 13; Raffard-Bregnet, Nov. 27; construct., French, Nov. 27; predetermination of characteristics of, Kapp, Dec. 4–18; Gramme ring, magneto-elec. induction theory as applied to, Dec. 4; Elwell-Parker, Dec. 11; Mather, Dec. 11-6.

" DYNAMOS, construct. *Elec. World*, Feb. 5; motors, small, requirements of, S. G. Wheeler, Feb. 19; Eickmeyer's, Mar. 12; Elwell-Parker alt. current, Apr. 16; Am. (Wood), Apr. 23; motor, small, C & C Co. Apr. 30; reg., Perkins, May 7; Baxter's motor, June 11; motors, small, effic. of, Clifford, June 25-7.

" DYNAMOS, Faraday disc, *Elec. World*, July 2; motors, effic., Emmons, July 2; Brown (Oerliken), July 23; Schuyler, July 23; aut. reg., Brown's, Grueninger, July 30; Bradley multipolar, Aug. 13; des., anal. of, Wagner, Aug. 27; Westinghouse alt. mach., Sep. 3; Waterhouse, Sep. 10; protection from lightning, Sperry, Sep. 24; motor, Schlesinger Ry, Oct. 22-7; coupling on same external circuit, Haskins, *West. Electric*. Nov. 26-7.

" DYNAMOS, Ferranti alt. current mach. *Sci. Am. Sup.* Jan. 20; Elphinstone-Vincent mach. Jan. 27; Siemen's generator, external armature and Gaulord-Gibbs secondary, June 2; Thom.-Hous. and sys. June 9-3.

ELECTRIC DYNAMOS, Hopkinson and Muirhead's mach. *Sci. Am. Sup.* July 14; Ball's unipolar, July 22-**3**; Siemen's, with friction driving gear, Jan. 12; Bessolo's and Siemen's open ring, Apr. 5; machs., prog. in, S. P. Thompson, Apr. 26; Kravogl's motor, June 14; Gerard's alt. current, 200 H. P. July 19; Thury's mach. July 26-**4**.

" DYNAMOS, Fourvielle's motor, *Sci. Am. Sup.* July 4-**5**; effic. testing, Kapp, June 12; Joel's eng. July 3; armature winding, Frige, Sep. 18; motors, prog., Robbins, Dec. 11-**6**; sys., S. D. Field, May 7; hand power driven armature, Hopkins, June 25; 8-light, G. M. Hopkins, July 2; machs, July 30-**7**.

" DYNAMOS, Ball's unipolar, *Eng.* Mar. 30; Hopkinson and Muirhead's, June 8; driven by Brotherhood engs., July 20; Ferranti, Aug. 24; Edison, with Porter-Allen eng. Aug 31; do. for isolated plants, Sep. 7; Ferranti continuous current generator, Sep. 21; do. effic. of, Oct. 19; Siemen's, with friction driving gear, Oct. 19-**3**.

" DYNAMOS, dynamo and 3-cyl. eng., Matthews, *Eng.* Feb. 22; Gramme, Mar. 28; testing, May 2; tests, May 16; Ganz, May 16; Rieter, June 6; 1000-light Ferranti, Health exhib. Oct. 10; Vanderpœle, Phil. exhib. Nov. 7; Ball unipolar, telemeter and gov. do. Nov. 14; Brush sys., do. Nov. 28-**4**.

" DYNAMOS, mach., bk. n. *Eng.* Jan. 2; do. 7-ft Wimhurst, Jan. 16; Edison-Hopkinson, Jan. 30; driving, Mather sys. Feb. 13; and photometrical tests at Munich, '82, rep. Feb. 27; and eng., Inv's exhib., Kapp, Aug. 28-**5**; Edison-Hopkinson, effic. May 7; Brush colossus, Oct. 8; Thom.-Hous. Dec. 5-**6**; Brown, Mar. 11; friction driving gear, Raworth, Nov. 25-**7**.

" DYNAMOS, Elphinstone's, *The Eng.* Jan. 5; Westminster Aquarium exhib. Apr. 27; Gramme mach. May 25; Edison-Hopkinson mach., F. S. Sprague, Aug. 10; Ferranti mach. Nov 2, 2-**3**; mach. at Vienna exhib. Feb. 1; Schuckert, Mar. 7; eng. gov., Willan's, June 13; Thom.-Hous. Oct. 3-**4**.

" DYNAMOS, Edison-Hopkinson, *The Eng.* Feb. 27; Patterson's machs. July 3, 17; Forbes non-polar, July 17; Kapp's, and Allen eng. combined, July 31; effic. July 31; Elwell-Parker's, July 31; "Manchester," Aug. 7; Gulcher, Aug. 21; Thom.-Hous. Aug. 28; Victoria, Sep. 11-**5**; machs., effic. testing, Kapp, Mar. 5, 12; great, Brush Elec. Co. Nov. 19, Dec. 17-**6**; and lamp, Lever's, Oct. 21-**7**.

ELECTRIC DYNAMO MOTORS, pyro-magnetic, *Iron Age*, Sep. 1-**7**; *Am. Eng.* Aug. 24, Sep. 7-**7**; *Ry. & Eng.* Oct.-**7**; elec. gen. from coal, Edison, *Fran. Inst.* Oct.-**7**; generator, do. *Electric.* Sep; thermo-magnetic, Houston and Thomson, Sep.-**7**; *Elec. Rev.* Aug. 27, Dec. 31-**7**; direct from fuel, *Elec. World*, Aug. 20, 27-**7**; *Sci. Am.* Aug. 27-**7**; *Manuf. & Builder*, Sep.-**7**; Edison's, *The Eng.* Sep. 16-**7**.

" EARTH CONDUCTION, Adams, *Van Nost.* Sep.-**6**; *Electric.*

" EARTHQUAKE INDICATOR, seismometer, Moses, *Elec. Rev.* July 2, 30-**7**. See also EARTHQUAKES.

" EEL, *Elec. Rev.* Dec. 25-**6**.

" ELEC. MO. FORCE, standard, *The Eng.* Aug. 21-**5**.

" ELEMENTS, Fiske, *Electric.* June, July, Sep.-**3**.

" ELECTRICAL ENGINEERS, Am. Inst. pro. *Electric.* Jan. Apr. June, Oct.-Dec.-**7**; in Japan, Fujioka, Mar.-**7**; Am. Inst. rules, *Elec. Rev.* Mar. 20-**6**; eng. course in tech. schools, Hutton, Nov. 26-**7**; eng. Prescott, Apr. 9-**7**; do. *Chautauquan*; eng. school of London, *Elec. World*, Oct. 4-**4**; Am. Inst. pro. May 28-**7**; eng. Inv's exhib. *The Eng.* May 1, 8, 22, June 26, July 3, 17-31, Aug. 7, 21, 28, Sep. 11-**5**.

" EXHIB., of Fran. Inst., '84, *Fran. Inst.* Apr. Aug. Oct.-Dec.-**4**; do. Jan.-Dec.-**5**; do. general rep. July-**5**; do. Jan; and pure research, Dec.-**6**; do. Snyder, *Electric.* Feb; Am. Inst., N. Y. rules, Aug.-**7**; Phil., Sep. 2-Oct. 11, '84, May, Sep, Oct.-**4**; Vienna, *Elec. Rev.* June 7; Munich, Aug. 9-**3**; Phil. Apr. 3, June 28, July 26-**4**; do. *Elec. World*, Mar. 29, Apr. 26, June 7, 21, July 5, 26, Aug. 16, 30, Sep. 6; first, at Royal Inst., London. 1810, Apr. 12; Am., Boston, Nov. 22-**4**.

EXHIB., Vienna, *Sci. Am. Sup.* Oct. 27-**3**; do. Mar. 15-**4**; do. *Eng.* Feb. 23, Sep. 21, Oct. 5-26, Nov. 2-30, Dec. 7-28-**3**; do. teleg. and teleph. Jan. 4; do. Ry. exhibs. Jan. 18, 25; do. Feb. 1, 22, Mar. 14, 28; Phil. May 2, Oct. 3 &c.-**4**; do. Woodbury, Jan. 2; Paris, Mar. 27-**5**; Vienna, *The Eng.* July 27, Aug. 24, 31, Sep. 7-**3**; Phil. Sep. 5, Oct. 17, 24, Nov. 7, 21-**4**.

" FANS, for hot weather, *Elec. World*, July 23-**7**.

" FIRING, explosive purposes of, Abel, *Van Nost.* July-**3**; *The Eng.*

" FOUNTAINS, illum. of, *Elec. World*, Nov. 8-**4**; *Sci. Am. Sup.* May 2-**5**; *Eng.*

ELECTRIC FURNACE, Cowles, *Fran. Inst.* Oct.-**6**; generator, Berliner, *Elec. Rev.* Sep. 10; Cowles, Sep. 24-**7**; do. T. S. Hunt, *Elec. World*, Oct. 24-**5**; generator, Berliner's, Sep. 10-**7**; Cowles', and prod. of aluminum and its alloys, *Soc. Arts*, Feb. 11-**6**.

" FUSION, *Sci. Am. Sup.* Apr. 24-**6**. See also ELEC. WELDING.

" GALVANOMETERS, constant det., Hooper, *Electric.* Mar; cheap, and thermopile, Penny, Mar; Lippman, Aug.-**4**; Deprez, Feb; tangent, mammoth, at Cornell, Anthony, Oct.-**5**; do. June-**6**; imperfection of, Rayleigh, *Elec. Rev.* Nov. 8-**3**; Bunnell & Co's, July 19-**4**; Jones, Apr. 25-**5**; tangent, Hartman and Kohlrausch, Nov. 20; portable, Nov. 27-**6**; coil comparing, Skinner, Aug. 27-**7**.

" GALVS., and bat. test, E. R. Barker, *Elec World*, May 31; at Phil. exhib. Sep. 27, Oct. 11, Nov. 8, 22, Dec. 27-**4**; Rosenthal's micro-galv. Apr. 11; Apr. 25; Lippmann mercury, Aug. 1; Kohlrausch's spring, Sep. 26-**5**; do. Jan. 23-**6**; Hartmann, Oct. 10; Edelmann's medical Oct. 21; do. astatic, Dec. 12-**5**; imp. May 8; tangent, Cornell, May 20; tangent, scale for, W. H. Preece, Nov. 13-**6**; correction factor, Skinner, June 18; coils computing, do. Sep. 3-**7**; Rosenthal's, *Sci. Am. Sup.* May 16; Gray's reflecting, June 6-**5**; Obach's, *Eng.* Aug. 3-**3**.

" GAS LIGHTER, *Elec. Rev.* Aug. 21-**6**; and buttons, Jan. 22-**7**.

" GASES, passage through, theory of, S chuster, *Sci. Am. Sup.* Aug. 23-**4**.

" GAUGE, *Elec. Rev.* Jan. 24-**5**.

" GENERATION, Kendall, *Sci. Am. Sup.* Mar. 15-**4**; turbo generator, Parsons, *Eng.* Apr. 22-**7**.

" GOVERNOR, Willan, *Mech.* July-**4**; motor, Ayrton, *Electric.* Sep.-**3**; Amet, Feb.-**5**; Willans, *Eng.* Feb. 15; Westinghouse, June 13-**4**; Jamieson, Jan. 9-**5**.

" HATCHING, *Elec . World*, Aug. 2-**4**.

" HEAT AND LIGHT, Gray, *Elec. Rev.* Apr. 19-**3**; transmission of heat into, Case ap. July 17-**6**; heater for st. Ry. cars, Burton, July 2-**7**; heating vs. stm., table, *Electric.* Feb.-**5**.

" HISTORY, Levison, *Electric.* Jan.-Dec.-**3**; Feb, Apr, June-**4**; Maver, *Elec. World*, Mar. 1, 29, Apr. 12, 26, May 24, June 28, Aug. 9-**4**.

ELECTRIC HORSE SHOEING, *Sci. Am. Sup.* June 28-4.

" HOTEL ANNUNCIATOR SYSTEM, Seiler's, *Elec. World*, July 16-7.

" INDICATORS, Prescott, *Elec. World*, Mar. 27-6; indicating instrums. of Edison Co. Dec. 24-7.

" INDUCTION. See also ELEC. CURRENTS, SELF-INDUCTION, ETC.

" INDUCTION, D. Brooks, *Electric.* Jan.-6; composite spark characteristics, Moncel, *Elec. Rev.* Apr. 26; May 17, 24-3; suppressor, Jackson, Aug. 8-5; coils, graph. treated, Kapp, *Elec. World*, June 11; self-induc. and mut. measuring, Ayrton's secohmeter, July 16; coil, retardation in, Stanley, Dec. 24-7; volta, W. Smith, *Sci. Am. Sup.* Dec. 29-3; and conduction, do. Apr. 18-5; mach., Wimhurst, July 3-6; balance, Bell, *Eng.* Jan. 5, Feb. 2, Mar. 9-3; machs., Wimhurst, Inv's exhib. May 1-5; volta-induc., W. Smith, *The Eng.* Nov. 16, 23-3; volta, and magnets, do. July 4-4.

" INDUSTRY, France, '82, *Electric.* Feb.-3.

" INSTRUMENTS, protector, Cartwright, *Elec. Rev.* Oct. 3-5. See also ELEC. GALVS., MEASURING, METERS, ETC.

" INSULATION, high, C. Haskins, *Electric.* Mar.-7; insulator, oil as an, expts., Frempt, May-6; ozokerit purifying ap. *Sci. Am. Sup.* Oct. 10-5; do. *The Eng.* Sep. 4-5.

" INVENTIONS, Beeman, *Van Nost.* Apr.-5; protection of, Jamins, *Elec. World*, June 20-5; *Eng.* June 26-5; Beeman, *The Eng.* Jan. 9-5.

" LAMPS, safety, *Iron Age*, Oct. 29-5; sun, *Electric.* Nov.-3; regs., hist., Keith, Feb.-4; Pilsen's, *Elec. World*, Mar. 22, 29; Berstein, or Boston, June 14-4; Crompton's, *Eng.* Mar. 16-3; Street-Maquaire, Jan. 8-6.

" LAMPS, ARC, carbon, resists. *Iron Age*, July 16-5; Forbes, *Mech.* Jan. 13-3; carbons, rep. *Fran. Inst.* June-5; Brush, review of controversy, F. L. Pope, *Electric.* Sep; Crompton, Oct.-4; carbons, May; actual candle power, Adams, Nov.-5; Levison's focusing, Feb.-7; Rogers, *Elec. Rev.* Feb. 21; Kay, Apr. 18; rep. July 11-5; and regs., Keith, *Elec. World*, Jan. 26, Feb. 2-23, Mar. 8, 22, May 31; Crompton, Aug. 23; Brush, hand, Oct. 18; Gerard, Oet. 25-4.

" LAMPS, "Lever," *Elec. World*, May 16; frictional clutch, E. P. Thompson, July 11; tests, Phil. exhib. July 11-5; Street-Maquaire, Feb. 13; Hyde's, July 17-6.

ELECTRIC LAMPS, carbon manuf. *Elec. World*, July 2; Wood (Am.) focusing, Dec. 10-**7**; ht. and distrib. of, for illuminating, Badt, *West. Electric.* Dec. 3-**7**; Schmidt's, *Sci. Am. Sup.* Oct. 20-**3**; Street and Maquaire, May 22-**5**; Clark, *Eng.* Jan. 25; Crompton, July 11-**4**; Rogers, Jan. 30; Belfast, Newton, Feb. 6; lightning arresters, Mar. 6-**5**; Vienna, elec. exhib. *The Eng.* Oct. 5, 19, Nov. 2, 23, Dec. 28-**3**; Crompton's, May 23-**4**; Gramme's, Nov. 13-**5**.

" LAMPS, INCANDESCENT, Cruto, *Iron Age*, July 9-**5**; candle power, tables, *Am. Eng.* Oct. 8, 15-**5**; filaments, new meth. of making, *San. Eng.* Jan. 29-**7**; effic. expts., Gale, *Van Nost.* July-**4**; econ., Weaver, Mar.-**5**; rep. *Fran. Inst.* Sep; duration and effic. do. Oct.-**5**; tests, Feb.-**6**.

" LAMPS, INCAND., econ., Weaver, *Electric.* Apr, Sep; glow, Preece, May; pat. June; measurement, colominetric, Penkert, Sep; av. duration, meth. of obtaining, Fleming, Nov.-**5**; effic., Hering, Jan; changes in resist. of, A. C. White, Jan; Moses, Mar; tests, Tatham, Apr; do. Woodhouse and Ranson, table, May; lit. July; Edison filament case, Sep.-**6**; glow, Webber, Feb, Mar.-**7**.

" LAMPS, INCAND., Siemen's and Halske's. econ., W. Siemens, *Elec. Rev.* Oct. 11; tests, table, Nov. 1; Maxim, Nov. 15-**3**; connection between strength of light and duration in glow of, Edison expts. Jan. 28; Stanley and Thomson, Oct. 4-**4**; hist. Feb. 28; mouth, Apr. 25; Sawyer-Man, May 23; Jenney, Ang. 8-**5**; Mar. 20; glow, Bernstein, July 3; manuf. Dec. 18-**6**; glow, Webber, Jan. 1; glow sys., Schuyler Co. Mar. 5; manuf., Swinburne, Mar. 19, 26, May 7; portable, Friedlænder, July 23; Aug. 6; and switches, Sawyer-Man, Dec. 24-**7**.

" LAMPS, INCAND., Weston's, *Elec. World*, Sep. 13; do. mammoth, Oct. 11-**4**; curious phenom., Houston, Mar. 21; Edison effect, May 9; pat. suits, illus. May 16; photometer for measuring intensity, May 23; air exhausting ap. May 30; tests, Fran. Inst., Phil. Aug. 29-**5**; do. Jan. 30; hist. Feb. 27; Westinghouse, Apr.-**3**; photom. measurements, A. P. Wright, July 3-**6**; on arc circuits, Diehl's sys. Feb. 12; regulation by secondary bats. Aug. 13; Westinghouse, Sep. 3-**7**.

" LAMPS, INCAND., Trouve's portable, *Sci. Am. Sup.* Dec. 29-**4**; Cruto's, May 9-**5**; Moses, *Eng.* May 11-**3**; Edison, Elec. exhib. Dec. 19-**4**.

ELECTRIC LAMPS, Trouve portable, *Eng.* Jan. 2; life of, Oct. 23, Nov. 6-5; low-resist. glow, Apr. 9; Weston, May 28-6; Bernstein glow, Feb. 4-7; Vienna elec. exhib. *The Eng.* Sep. 21-3; effic. and duration testing, Fran. Inst. rep. Sep. 13-5.

" LARYNGOSCOPE, Seiler, *Electric.* July-3; Meyer, Oct.-5; and otoscope, *Elec. World*, May 2-5.

" LAWS, anal. of Ohm's and Joule's, Curtiss, *Elec. World*, Mar. 28-5.

" LIGHT AND HEALTH, *Eng.* July 4-4.

" LIGHTERS, *Elec. Rev.* Apr. 10-4.

" LIGHTING. Including ARC LIGHTING. See also ELEC. LIGHTING, INCAND.

" LIGHTING, Nat. Assoc. pro. *Electric.* Sep.-5; Mar, Oct.-6; Mar., Sep.-7; *Elec. Rev.* Aug. 22, 29-5; Feb. 13, 20, Sep. 11-6; Feb. 19, Aug. 13, 20-7; *Elec. World*, Aug. 22-5; Feb. 20, Sep. 11-6; Feb. 19, 26-7.

" LIGHTING, Co's, *Eng. News*, Feb. 14; notes, June 23; plants and storage bats., dangers of, Nov. 10-3; arc, Heinrichs, Feb. 13-6; and stm. power, *Iron Age*, Sep. 3-5; at Prague, Otto gas eng. Jan. 27-7; Hochausen sys. *Mech.* Feb. 9, Mar. 22, Apr. 19; bats. Mar. 8-4; econ. of, *Am. Eng.* Dec. 12-4; at Prague, Otto gas eng. Nov. 17; Am. plant, Nov. 17-6; in wks. and factories, Oct. 12-26, Nov. 2, 9-7.

" LIGHTING, comparison with gas, rep., Ger. *San. Eng.* June 18-5; Edison distrib. in Boston, junction box details, Jan. 8-7; arc, by tower sys. *Eng. & Bu. Rec.* Dec. 24-7; *Ry. Gaz.* Nov. 12-6; and force, transmiss. of by elec., Siemens, *Van Nost.* Feb., in mills, Woodbury, Mar; devel., Gordon, Oct. Hopkinson, Nov-3; bats., primary, for, Probert, Sep.-4; *Ry & Eng.* Jan; station, Oct.-7; in mills, *Fran. Inst.* Jan.-3.

" LIGHTING, in mills, *Electric.* Jan; tests, table, Feb; hist., Lancaster, Mar; plant at St. Denis, France, Mar; Co's, list of, May; station, Partz sys. May; on Brooklyn bridge, June; Tacy, July; in Paris, July; discov. July; Co's, European, Aug; Dec.-3; tests, Cin. exhib., F. L. Pope, Apr.-June-4.

" LIGHTING, Edison Co. isolated, rep. *Electric.* Feb; station, test, Harrisburg, Pa. Feb; in Am., Preece, Mar, Apr; Chicago, Conv. pro. Apr; arc, Boston, Apr.-5.

ELECTRIC LIGHTING, on Brighton Ry., Slingo, *Electric.* Apr; Vienna, n. June; Edison pats. claims, June, July; station, Milan central, Aug; san. superiority, Van der Weyde, Aug; private instal., Naile, Sep.-5.

" LIGHTING, London, Lain, *Electric.* Feb; Edison sta., Harrisburg, test, Feb; relation to ins., Woodbury, Mar; plants, operating exp., Weeks, Mar; Moses, Mar; station, Boston, rep. Mar; sta., Boston, rep. Mar; arc plants, Orford, May-Aug; at Trenton, N. J. Sep; Co's legal relations to teleg. and teleph. Co's and pat. office, Steuart, Oct; vs. gas, effects on temp. and atmos. of rooms, tests, Breslauer, Berlin, Oct; distrib. of arc and incand. lights on same circuit, Lemp, Nov; and ærial wires, Haskins, Nov; Dec.-6.

" LIGHTING, and reversible lead bats., Fitz-gerald, *Electric.* May; station construct., Powers, June; power required, Aug; Westinghouse alternating sys., F. L. Pope, Sep; Edison station, table, Nov; in mills, Woodbury, Nov, Dec; Addenbrooke, Dec.-7.

" LIGHTING, econ. of, Van der Weyde, *Elec. Rev.* Apr. 5; in conservatories, Apr. 5; Colt disk eng. Apr. 12; Edison village plant sys. Apr. 12; Hopkinson, May 3; Nottingham, May 11; Grands magazines du printemps, Paris, May 31, Am. & Illum. Co., Boston, June 7; Thom.-Hous. sys. June 14; at Abbeville, France, June 28; July 19, 26; plants, Aug. 2; cost compared with gas, Aug. 9; arc. Jenney, Aug. 16; Brush, at Evansville, Ind. Aug. 30; arc, sta., Stanton st. Dec. 27-3.

" LIGHTING, Brush-Swan sys. *Elec. Rev.* Jan. 10, 17; Brush, Buffalo, Jan. 28; plants, Jarvis Eng. Co. Feb. 28; Mar. 27; arc, carbon manuf. Apr. 17; prog., Preece, Apr. 17, May 17; Am. & Illum. Co., Boston, rep. May 31; absolute standard of, June 14; Buffalo Co. June 28; Brush, Rochester, N. Y. Aug. 9-23; Edison cen. sta. sys. Aug. 23; Pilsen sys. Dec. 20; Weston, Dec. 27-4.

" LIGHTING, at Hachette Publishing H., Paris, *Elec. Rev.* Jan. 17; arc carbon making, Jan. 31; Cen. Ry. sta., Buda-Pesth, Jan. 31; N. E. Weston Co., hist. Feb. 28; conv. pro. Mar. 7; Schuyler sys. Mar. 28; arc resist., Penkert, Apr. 4; Western Co's sys. Apr. 11; cen. sta., Jenks, Apr. 18; Brush sys. June 6; in cotton mills, N. E. Cotton Mfgs. Oct. 3-5.

ELECTRIC LIGHTING, as an illum. *Elec. Rev.* Mar. 6; Ins. Co., Woodbury, Mar. 13; hist., Beane, Mar. 20; Waterhouse sys. May 1; Brush Co. May 22; arc carbon holder, Stupakoff, July 3; Silverton, England, July 3; by wind power util. Aug. 7, 21; Chicago Co's, Aug. 14; Sun Co, distributor, Aug. 28; and ærial wires, Haskins, Sep. 25; vs. gas, heating effects in theatre, Dreslauer, Sep. 25, Nov. 27; testing bridge, Davies, Oct. 16; distrib. box, Oct. 23; arc, inverse el. mo. force of, Cross, Nov. 6-6.

" LIGHTING, conv. pro., Mather plant, *Elec. Rev.* Feb. 26; Edison sta., Harrisburg, Pa. May 28; Slattery, June 4; arc carbons, Zucon's, June 18; Paris opera, June 25; sta., Holborn, England, July 2; cen. sta., measurement of elec. for, Aug. 13; Thom.-Hous. fact., Lynn, Aug. 20; Sun sys. Sep. 10; wiring rules, Dec. 3; cost of, Sternes, Dec. 3-7.

" LIGHTING, Excel. Elec. Co. sys., Mailloux, *Elec. World*, Jan. 5–19; Brush sta., Rochester, Mar. 22; Boston sta. Mar. 29; Sheehy's sta. switchboard, Apr. 26; towers, July 5; in flour mills, Greenhill, Aug. 2; Van Depœle sys. Sep. 27; in Am., Preece, Dec. 27-4.

" LIGHTING, Thom.-Hous. sys. at Phil. exhib. *Elec. World*, Jan. 3; econ. of, Stirling, Jan. 3; underground, Reynolds, Jan. 24; in N. Y. City, prog. Jan. 31; conv. pro. Feb. 28; reg. and indic., Weston's, June 13; Brush fact. at Cleveland, Aug. 1; Jenney sys. Aug 8; arc, Sperry sys. Aug. 22; do. Schuyler sys. Sep. 5; growth of, Sep. 19; arc sys. Am. Elec. Mfg. Co. Oct. 24, 31; econ. of fuel in, Nov. 7; prog. in '85, Dec. 26-5.

" LIGHTING, arc, Heinrich's sys. *Elec. World*, Jan. 16; Brush sta., Boston, Mar. 6; Schæfer sys. Apr. 10; arc, time table for lighting pub. lamps, Howells, Aug. 14; by water power, Aug. 21; Brush sta., Cleveland, Aug. 28, Sep. 18; Thom.-Hous. sta., Lowell, Oct. 9; plant for statue of liberty, Oct. 30; sta., Prague, Nov. 6; prog., Poisons, Dec. 4-6.

" LIGHTING, munic., Edison sys. *Elec. World*, Feb. 12; Brush sta., Phil. Feb. 12; sta., Fort Wayne, Jenney, Feb. 19; Thom.-Hous. citizen's, Brooklyn, July 2; Ferdinand st., Boston Elec. Lt. Co. Aug. 13; Edison sta., Detroit, Sep. 10; multiple arc distrib., Edison pat. Sep. 10; Thom.-Hous. sta., Nashua, N. H. Sep. 17; cost of domestic, Salomons, Nov. 19-7; Atkinson, *West. Electric*. July–Dec.-7.

ELECTRIC LIGHTING, Thom.-Hous. sys. *Sci. Am. Sup.* June 9; Zipernowsky sys. July 28; arc, candle, Morin's, Sep. 1; arc carbon making mach. Dec. 29-**3**; Stanton st. sta., N. Y., U. S. Illum. Co. Feb. 9-**4**; and ærial wires, Haskins, Dec. 11-**6**; arc carbons manuf. Dec. 13-**7**; Thom.-Hous. sys., E. Thomson, *Soc. Arts*, May 24-**3**; Edison cen. sta. sys., Jenks, Feb. 3-**5**.

" LIGHTING, in mills, *Eng.* Jan. 26; plant, St. Denis, Jan. 26; do. Weiller, Feb. 16; cost of, Mar. 2; by Gordon mach. Mar. 9; exhib., Aquarium, London, Mar. 16; at Union Soc., Oxford, Apr. 27; May 25, June 1; Zipernowsky sys. June 15; at Fisheries exhib. June 29, Nov. 2; plant, Louvre, Paris, July 27; Edison sta., Milan, Aug. 31; Edison fittings, Sep. 14, 28; plant, Mag. du printemps, Paris, Oct. 19; signalling and storage of power in coal mines, Nov. 3-**3**.

" LIGHTING, arc, Hochausen sys. *Eng.* Jan. 11, Feb. 8, Mar. 14; conductors, Apr. 18; sta., Boston, June 27; July 25, Sep. 5, 12, Oct. 3, 17; Health exhib., Gerard, Sep. 5; do. Oct. 31; Sep. 12; Gulcher sys. Nov. 7-**4**.

" LIGHTING, sta., Buda Pesth, *Eng.* Jan. 2; at Havre graving dock, Jan. 9; wks. Temesvar, Hungary, Jan. 30; reg., Phidol., Turkey, Feb. 27; aut. reg., Phidol, Laconie, Mar. 20; sys., Inv's exhib. May 1; Thom.-Hous. sys. May 1; Siemens instal., Inv's exhib. May 15; Goolden dynamo ap. May 22, 29; in mills, Hartwell, July 3; plant, Greenock, July 17; Weston sys., N. Y. July 24; do. fittings, Aug. 21; Neville, Aug. 21; Lincoln's inn, Nov. 20-**5**.

" LIGHTING, Lucerne sta. *Eng.* Jan. 29; factory lighting, Weston, Apr. 23; Thom.-Hous. sys., Phil. exhib. Dec. 12; sta. instruments, Paddington, Dec. 31-**6**; Bernstein sys. Jan. 7; at Col. & Ind. exhib. Jan. 21; Manches. exhib. May 6, June 24; Vienna Town Hall, June 10, 24; on Isle of May, D. A. Stevenson, Aug. 12, 19; in wks. and facts., Fleming, Sep. 30, Oct. 7; arc. carbon electrodes manuf. Nov. 18-**7**.

" LIGHTING, cost, *The Eng.* Feb. 2; Hopkinson, Apr. 20; at Nottingham, May 4; plant, Fish. exhib. May 11; at Leeds, May 25-**3**; in Brixton, Jan. 11; fittings, Feb. 29; Health exhib. May 23; arc, Am. sys. Sep. 26; at Montreal, Oct. 3; Weston's, Phil. exhib. Oct. 17; Victoria sta., Swan-Edison, Nov. 28, 28, Dec. 5–19, 19-**4**.

ELECTRIC LIGHTING, mach., Mather, *The Eng.* Feb. 13; power expended in, Kapp, Feb. 27; tower sys., Elgin, Ill. Mar. 6; sys., Inv's exhib. Apr. 17; and gas, penetrative power of, Sep. 4; of Antwerp, Nov. 20; by induction, Dec. 4-5; at Col. & Ind. exhib. May 28; shed, do. May 14; at Edinb. do. June 11; at Liverpool, do. Sep. 24-6; at Col. & Ind. do. Jan. 28; sta., Whiteley plant, England, Feb. 18; sta., Hadfield mills, Feb. 25; from cen. stations, Swan-Edison, Williamson, Dec. 16-7.

" LIGHTING, INCANDESCENT, cost of, Equer, *Eng. News*, June 27-5; incand. lamps on arc circuits, *Iron Age*, Jan. 20-7; on str. Arizona, *Mech.* June 2-3; mercury vac. pump, Weston, Sep.-5; cutout, Little, July-6; domestic, for dwellings, *Am. Eng.* Oct. 27-6; on U. S. cruisers, Murdock, *Ry. & Eng.* Oct.-7.

" LIGHTING, INCAND., prog., U. S., n. *Electric.* Apr; measuring standards, Aug.-5; Bernstein glow, May; size of conductors when lamps are in multiple arc, Leonard, Aug; carbons, Hickley, Oct; Edison pats. and legal status, Dec.-6; leads, C. Hering, Jan; on high tension circuits, Wetzler, Mar; by reversible lead bats., Fitzgerald, May, July; of R. trains, G. W. Blodgett, July; do. Carswell, Nov.-7.

" LIGHTING, INCAND., Eden theatre, Brussels, *Elec. Rev.* Mar. 22; Bernstein sys. May 31; vs. gas, July 12-3; Feb. 27; Schaefer sys. Apr. 10; Preece, Apr. 17; 300-light, Schuyler, Jun. 26; lamps on arc circuits, Ridlon, Nov. 20-6; on U. S. Avery, cruisers, Sep.-7.

" LIGHTING, INCAND., in theatres, Royal Manchester, England, *Elec. World*, June 14; on strs. June 21; carbon filament, chem. of, E. P. Thompson, Oct. 25, Nov. 1; on English transports, Nov. 22-4; N. Orleans exhib. Mar. 21; on arc circuits, Aug. 15; growth, Oct. 3-5.

" LIGHTING, INCAND., by low resist. glow lamps, Bernstein, *Elec. World*, Apr. 17, 24, May 1; size of conductors for, Leonard, July 24; from arc light circuits, Ridlon, Nov. 20; Howell's meth. of indic. potentials of incand. circuits, Dec. 11-6; long dist., Slattery, Feb. 12; Fort Wayne, Jenney sys. July 16-7; theatre, Munich exhib. *Sci. Am. Sup.* Nov. 10-3; Scala theatre at Milan, May 31-4; domestic, Hospitalier, Apr. 18-5; Clerc's aut. commutator for, Sep. 4-6; from arc light circuits, Ridlon, *Soc. Arts*, Nov. 11-6.

ELECTRIC LIGHTING, INCAND., Brush sys. *Eng.* Feb. 9, May 25, June 1; str. Himalaya, Feb. 16, Arizona, May 4; Brunn theatre, Aus. Apr. 13; Eden theatre, Paris, June 22; domestic, Swan, July 20; in Louvre, Paris, July 27; plant on str. Oregon, Oct. 12; on shipboard, Nov. 30-3; do. Apr. 4-18; Swan and Edison, Health exhib. June 27; dynamo and bat. compared, Sep. 12; Weston sys., Phil. exhib. Oct. 24; on str. Colossus, Nov. 21-4.

" LIGHTING, INCAND., str. Oceanien, Gramme and Megy motor, *Eng.* Mar. 27; 3-wire Edison sys. Apr. 17; strs. Etruria, &c., June 19; radiation from carbons, July 3; wires (mains), size, July 3; vac. pump, Weston, Aug. 7; domestic, Nevile, Aug. 21; in theatres, Cance meth., Oct. 23-5.

" LIGHTING, INCAND., theatre, Paris opera, *Eng.* Jan. 1-6; of trains, Carswell, Sep. 23; Dredge, Oct. 28, Nov. 18; Brown aut. converter, Dec. 23-7; str. Himalaya, *The Eng.* Feb. 9; mach., Wright's, May 25-3; on U. S. str. Albatross, June 20; Bethnal-Green museum, Aug. 8-4; on strs. Umbria and Etruria, Apr. 10-5.

" LAUNCHES, Reckenzaun, *Sci. Am. Sup.* Mar. 29-4.

" LINE CONSTRUCTION, Lockwood, *Electric.* July. Aug. Nov. Dec.-4; Jan.-Dec.-5.

" LOCK, Lockwood, *Elec. Rev.* Sep. 5-5.

" LOCOMOTION, econ. of, *Electric.* Mar.-5; Reckenzaun, June-7; limit of speed, Sabine, *Elec. Rev.* July 12-3; prog. of, Farmer, *Elec. World*, Dec. 20-4; and magnetic, hist., Bentley, *The Eng.* Sep. 19-4.

" LOCOMOTIVE, mining, tests, table, Reckenzaun, *Electric.* July-6; tests, *Elec. Rev.* May 22-6; Hal'ls, of 1850, *Elec. World*, Jan. 10-5; Page's, *Sci. Am. Sup.* Feb. 28-5.

" MACH., influence, Voss, *Electric.* June; Atkinson's, Oct.-3; do. 4-plate, Topler, *Elec. World*, Mar. 29; Benjamin's Voss-Holtz, Oct. 18-4; high press. influence, Hempel, *Sci. Am. Sup.* Oct. 10-5; Wimhurst, Mar. 12-7.

" MAGNETISM. See also ELECTRO-MAGNETISM.

" MAGNETISM, cause of, in steel and metals, *Iron Age*, Sep. 6-3; magnetization changes in length, rods of iron, steel and nickel, Bidwell, *Electric.* June-5; relation between magnet core and magnetizing force, French, Dec.-6.

ELECTRIC MAGNETISM, action of iron as magnetic screen, *Elec. Rev.* Mar. 29; luminosity of magnets, J. T. Sprague, June 7; cause of, in iron, steel etc., Hughes, June 14, 21-**3**; in watches, Toppan, May 14, June 25, July 30; do. Haskins, Nov. 5; magnetic bridge, Eickmeyer, Aug. 27; S. S. Wheeler, Nov. 12-**7**.

" MAGNETISM, theory of, Hughes, *Elec. World*, Mar. 29, Apr. 5, 12, 26; magnetic polarity and neutrality, do. May 24, June 28, July 12-**4**; mag. effects on iron and steel bars, Bidwell, May 30-**5**; magnet winding, Hering, Jan. 16, Feb. 13, Mar. 6, 20-**6**; magnetization, el. mo. force of, E. L. Nichols, Sep. 24-**7**.

" MAGNETISM, cause of, in iron and steel, Hughes, *Sci. Am. Sup.* June 23, July 7-**3**; magnetic separator, Feb. 23; magnetic balance, Hughes, Mar. 22; terrestrial, Owen, Mar. 29-**4**; magnetic separation of minerals at Oberlahnstein, Heberle, Oct. 10-**5**; *Eng.* June 15-**3**; magnetic separator, Buchanan's, *The Eng.* Apr. 27; in iron and steel, cause of, Hughes, June 1-**3**; theory of, do. Apr. 4, n.-11-**4**.

" MEASUREMENT, and nomenclature, Nystrom, *Iron Age*, Nov. 13-**4**; do. *Mech.* Nov.-**4**; for commercial purposes, Shoolbred, *Van Nost.* Oct.-**3**; elec. mo. force of, in constant elements, Reynier, *Electric.* Jan; Ohm's law, July, Aug; F. L. Pope, Oct, Dec.-**4**; principles, do. Aug.-**5**; Wheatstone's bridge, proof, Salomons, Nov.-**6**; *Elec. Rev.* Oct. 18-**3**; and nomen., Nystrom, Nov. 29-**4**; June 19-**6**; Sep. 17-**7**; Weaver, *Elec. World*, Jan. 24-**5**; Shoolbred, *The Eng.* May 18-**3**; See also ELEC. MEASURING, METERS.

" MEASURING, instruments, spring for, *Iron Age*, Oct. 9-**4**; do. Eaton, *Electric.* Oct.-**4**; do. for vel. of projectiles, H. A. Sinclair, Apr.-**5**; do. Ayrton, *Elec. Rev.* May 31; do. Uppenborn's, Sep. 13-**4**; do. Phil. exhib., E. P. Thompson, *Elec. World*, Jan. 31-**5**; W. Thomson's, June 18-**7**; ap., Munich exhib. *Sci. Am. Sup.* Jan. 26-**4**; instrums., W. Thomson's, July 30-**7**. See also ELEC. MEASUREMENT.

" METERS. See also ELEC. GALVS, MEASUREMENT, MEASURING, UNITS.

" METERS, current, *Mech.* Dec. 29-**3**; testing, Gordon, July-**4**; Ritter, *Van Nost.* Jan.-**6**; current, Forbes', Houston, *Fran. Inst.* Dec.-**7**; Ayrton, Prescott, *Electric.* Jan; voltameter, silver, Anderson, May-**6**; Forbes, Nov.-**7**.

ELECTRIC METERS, Hopkinson, *Elec. Rev.* Apr. 19-3; voltameter, Eaton, Dec. 5-5; do. Sep. 4, Oct. 9; do. gauging, Mar. 6; W. Thomson, Aug. 14-6; Ohm-meter, Feb. 26; ammeter, U. S. Elec. Co. Apr. 30; Aron, July 16; current, Forbes', Oct. 8; Grove, Oct. 29; coulomb, Borel, Nov. 19-7; magnet, Carpentier's, *Elec. World*, Oct. 4-4; hist., in Am., Brock, Nov. 21, Dec. 5-5; Weston current and energy, Mar. 13, 27; electro-, contin. indic., Bichat, May 15-6; coulomb, Forbes', Oct. 22-7.

" METERS, current, Hopkinson's, *Sci. Am. Sup.* Apr. 21; solenoid galv., or ampere, Jamieson, June 16; Mascart's registering, Aug. 18; Marianim's re-electrometer, Aug. 25; and power, Boys, Sep. 29; current, H. Shaw, Dec. 8-3; quadrant, W. Thomson's, Feb. 9; current, Crompton and Kapp, Apr. 19; ampere, volta, and measures, Vienna exhib. June 7; Kohlrausch's ap. Aug. 9-4.

" METERS, calorimetric, volta and ampere, *Sci. Am. Sup.* Jan. 31; Cauderay's coulomb, Hospitalier, Oct. 17; Hartmann's mirror galvs. Oct. 24-5; ampere and volta-, Edelmann, July 31; voltameter, for elec. light, Aug. 28; do. electrostatic, W. Thomson's, Aug. 28-6; ammeter, Waterhouse, Nov. 5; current, Nov. 19-7.

" METERS, Hopkinson, *Eng.* Mar. 9-3; Mho-meter, Thomson, May 2-4; ammeter, Ayrton, June 20; volmeter, Cardew, Sep. 5-4; June 26-5; power, Boys, *The Eng.* June 8; current, Hele Shaw's, Oct. 26-3.

" MICROPHONE, contacts, Bidwell, *Mech.* May 19-3; expts., Hughes, *Electric.* Mar.-3; influence of surface condensed gas, Probert, *Elec. Rev.* May 17-3. See also TELEPHONE, MICROPHONE.

" MOTORS. See ELEC. DYNAMO MOTORS.

" ORE TREATMENT, Rae, *Elec. Rev.* Aug. 6-7.

" ORGAN MOVEMENT, Walker, *Mech.* Oct.-6. See also ORGAN.

" PAPERS, Brit. Assoc., O. J. Lodge, *Electric.* Nov.-7.

" PATENTS, U. S., '82, n. *Mech.* June 23-3; U. S. stat., '84, *Electric.* Feb.-5; do. Feb.-6; do. stat., '86, Feb.-7; do. '82, *Elec Rev.* Oct. 18-3; do. stat., Lockwood, Feb. 14-5 and files; *Elec. World* files.

" PHENOMENA, imitation of, by liquid or gaseous currents, Decharme, *Sci. Am. Sup.* Jan. 5-4; analogies with hydrodynamic effects, do. Oct. 3, 17-5.

ELECTRIC PNEUMATIC SYS., Clay, Phil. *Eng. News*, Nov. 20-**6**.

" POTENTIAL, energy and work, Fiske, *Van Nost.* May-**3**; current and resist., J. T. Sprague, *Elec. Rev.* Aug. 9-**3**.

" POWER, by Brown's dynamos, *Electric.* May; motive, W. Wharton, Nov.-**7**; of Niag. falls, J. Trowbridge, *Elec. Rev.* June 28-**4**; do. May 30-**5**; heat transformation into, with bats., thermopiles and dynamos, Penkert, *Sci. Am. Sup.* July 31-**6**.

" POWER DISTRIB., by secondary generators, Gibbs, *Van Nost.* June-**5**; Gaulard, *Elec. World*, Nov. 29-**4**; by Sprague motors, Boston, Sep. 3-**7**; Fiske, *Sci. Am. Sup.* May 5-**3**.

" POWER SERVICE, Martin. *Ry & Eng.* Oct.-**7**; *Elec. World.*

" POWER TRANSMISSION, *Iron Age*, Dec. 3-**5**; Van Depoele, June 3; Dec. 16-**6**; *Am. Eng.* Nov. 14-**4**; Nov. 26-**5**; Luce, *Van Nost.* Feb.-**5**; Van Depoele, May; energy, Kapp, n. Aug, Sep.-**6**; Julien sys., Salom, *Fran. Inst.* June-**7**; *Electric.* June-**3**; Jan; vs. steam, comp. air etc., in mines, Schulz, Apr; min. elec. mo. force, Carhart, Dec.-**5**.

" POWER TRANS., *Electric.* Jan; Upton, Mar; op. of motors from elec. light and power stations, Martin, Oct; Levy, Dec.-**6**; English expts., Fontaine, Jan, Feb; between Creil and Paris, expts., Deprez rep. Jan, Feb; by Brown's dynamos, May-**7**; *Elec. Rev.* Mar. 22; Apr. 5; French Inst. rep. May 10, 31; Grenoble expts. rep. Oct. 25-**3**; Mar. 27; May 24-**4**; Nov. 7-**5**; Sep. 25, Dec. 4-**6**; expts., Fontaine, Jan. 22; vs. compressed air, Sep. 17-**7**.

" POWER TRANS., Schlesinger, *Elec. World*, Apr. 18, May 2, 9; from central stations, May 16; between Creil and Paris, expts., Deprez, Nov. 28; do. machs. used in, Dec. 5; 1st, Dec. 12-**5**; expts., H. Fontaine, Dec. 4.-**6**; by Oerliken dynamos, Grueninger, July 23-**7**.

" POWER TRANS., at Bienne, Switz. *Sci. Am. Sup.* Jan. 24; Deprez expts. Dec. 19-**5**; do. between Creil and Paris, Jan. 23; Dec. 11-**6**; *Eng.* Mar. 23, 30; Apr. 27-**3**; Oct. 16, Nov. 6 &c.-**5**; Nov. 12-**6**; Lodge, *The Eng.* Jan. 26, Feb. 9, 23, Mar. 9, 16; A. Siemens, Apr. 13; Lodge, Aug. 24, Oct. 5-**3**; do. Jan. 11-**4**; July 30-**6**. See also TELPHERAGE.

" PROGRESS, Japan, Fujioka, *Ry. & Eng.* May-**7**; '83, *Elec. World*, Jan. 5-**4**; '84, review of, Jan. 3, 10, 24-**5**; in Am., '85, Jan. 2-**6**; in Am. *Eng.* Dec. 26-**4**; '86, Jan. 21, 28-**7**.

ELECTRIC PROPERTIES of german silver, Prescott, *Electric.* Apr.-**6**.

" QUANTITY, Wheeler, *Electric.* Nov.-**3**.

" REGISTERING AP., heat reg., telemeters, timepiece, clocks, rep. *Fran. Inst.* Jan.-**6**; dynamograph, wk. of machs. Resio, *Elec. Rev.* June 14-**3**.

" REGULATION, in 3 wire distrib. *Elec. World*, Apr. 16-**7**.

" REOSTATS, temp. coeffs., Anthony, *Electric.* June-**7**; wire, and Weston's, for laboratories, *Elec. World*, May 16.-**5**.

" RESISTANCE, n. *Iron Age*, Apr. 26-**3**; measuring, Uppenborn, *Electric.* Feb; pure copper wire, table, Prescott, June; Hering, Dec.-**5**; coils, polarization of, Thomas, Feb.-**7**; of human body, Stone, *Elec. Rev.* July 19-**3**; do. Aug. 16-**4**; of commercial iron, Preece, *Elec. World*, Sep.17-**7**; A. W. Waters, *Sci. Am. Sup.* May 10-**4**; of steel solutions, *Eng.* July 8-**7**; tester, Blackburn's portable, *The Eng.* Apr. 6-**3**; of platinoid, Bottomley, July 3-**5**.

" SCIENCE, advances, Trowbridge, *Mech.* Feb.-**5**.

" SIGNAL, box, dist., Talbot, *Elec. Rev.* June 7-**3**; signaling, Sep. 13-**4**; police, usual, Oct. 9-**6**.

" SIGNS AND SYMBOLS, *Eng.* May 15-**5**. See also ELEC. SYMBOLS.

" SMELTING, and Aluminum proc., Cowles, *Fran. Inst.* Feb.-**6**; proc. do. *Elec. Rev.* Sep 19-**5**; dynamo (largest), Thurston, Oct. 2-**6**; Cowles' proc. *Sci. Am. Sup.* Sep. 26-**5**; *Eng.* Sep. 11-**5**; *Eng. & Mining Jour.*

" SOLENOIDS, *Electric.* Apr.-**5**.

" SPARK, elec. mo. force of, Edlund, *Elec. Rev.* Apr. 2-**7**.

" STANDARDS AND RESISTANCES, Brit. Assoc. *Eng.* Sep. 23-**7**.

" STORMS, *Electric.* June-**3**.

" STORAGE BATTERIES, (accumulators; secondary) and arc lights, dangers of, *Eng. News*, Nov. 10-**3**; prog. *Iron Age*, Jan. 11; Faure accum. Mar. 8-**3**; Viaduct, Apr. 9; Kalischer, June 18; July 16, Sep. 10-**5**; (Elwell), Aug. 25; durability, Reckenzaun, Sep. 1-**7**; *Mech.* Jan. 6; Faure, Feb, 24-**3**; Sep. Oct.-**5**; Morton, *Van Nost.* June-**3**; Lodge, Mar; n. Aug.-**4**; Howard, Oct.-**5**; Plante and Faure accums., chem. of, *Fran. Inst.* Jan, July-**3**; notes, Oct.-**3**-Dec.-**4**; Apr.-**5**; Julien, *St. Ry. Gaz.* July; test, Weis sys. Sep.-**7**; for locomotion, Reckenzaun, Sep.-**7**.

ELECTRIC STORAGE BATS. (secondary), *Electric.* Jan, Mar; Elec. Accum. Co. May; June; expts., Aron, July; Brush, Nov.-**3**; n. Feb; elec. mo. force of, expts., Reynier, July-**4**; do. Mar; Jan; aut. cut-out, Prescott, May; Roberts, July; charging, Preece, July; Kalischer, July; plates, Dec.-**5**; Bauer, June, Sep, Nov; treatment, Drake, Nov.-**6**; pats. Jan; construct., Reckenzaun, Feb, Mar, May, July, Aug, Oct; Roberts, June; tests, Huber, Aug; Reckenzaun, Oct; for elec. locoms. do. Sep; Mailloux, Sep; Reckenzaun's, Julien tests, Prescott, Dec.-**7**.

" STORAGE BATS., *Elec. Rev.* Mar.22, 29, Apr. 5; Frankland, Apr. 12, 29; tests, Morton, Apr. 26; Lodge, June 21; J. T. Sprague, June 28, July 5; in mills, Oct. 11; Kabath accum. Nov. 1; and steam gen., Biggs, Nov. 22; Faure accum. Nov. 29-**3**; rep. Jan. 3; Feb. 14; Jarriant's, Mar. 13; Aug. 2; use in telegraphy, Preece, Nov. 1-**4**.

" STORAGE BATS., discharge of, Frankland, *Elec. Rev.* Jan. 3; Gaulard and Gibbs sec. gens. Feb. 7; Howard, July 11; Viaduct Mfg. Co. July 25, Nov. 28-**5**; pats. July 10–24, Aug. 14, 28; Aug. 7; construct., Reckenzaun, Dec. 25; U. S. pats. Oct. 9–23, Dec. 25-**6**; do. Jan. 1, 8, 29; plant, Jan. 1; Montaud's accum. Jan. 15; expts., Swinburne, Jan. 22, Apr. 16; Accum. Co. Feb. 12; power distrib. by, Feb. 26; Elec. Accum. wks. June 18, 18; construct., Reckenzaun, July 16, Aug. 13, 20; Smith, Aug. 6; Mailloux, Aug. 20; Duncan, Aug 27; Reckenzaun's, Sep. 24; Hedges, Oct. 1-**7**.

" STORAGE BATS., manipulator, Brush sys. *Elec. World*, Oct. 4-**4**; distrib. by, Feb. 7; Roberts, Feb. 28; tests, June 6; charging, Preece, June 27; Howard, July 4; large, Roberts, July 25; accum. electrodes, Reynier, Dec. 5-**5**.

" STORAGE BATS., indic. *Elec. World*, Apr. 3; 25 years ago, June 5; for light and power, Bauer, June 5; imps. Aug. 7; treatment of, Drake, Oct. 2; lithanode, D. G. Fitz-Gerald, Oct. 2; Julien accum. Nov. 20; Elec. Accum. Co. Dec. 11; construct., Reckenzaun, Dec. 18, 25; ap. for indic. charge of, Montaud, Dec. 18-**6**.

" STORAGE BATS., Montaud accum. *Elec. World*, Feb. 5; 100 H. P., Paris City Hall, Apr. 30; aut. switches, May 7; hist., Van der Weyde, May 7, 21; install. May 14; Julien cell, May 21; manuf. June 18; Phœnix, July 2; Peyrusson, Sep. 10-**7**.

ELECTRIC STORAGE BATS., and transmission, W. Siemens, *Sci. Am. Sup.* May 12; and piles, Munich Elec. exhib. Dec. 12; Lodge, Dec. 22-**3**; distrib. of elec. energy by, Gaulard-Gibbs sys., Gibbs, June 13; Gime's accum. July 18; Glaesener's, Aug. 29; Henderson, Nov. 28-**5**; bi-metallic, Jan. 16; Gadot's, Dec. 11-**6**; Montaud accum. Apr. 2, June 18; 100 H. P., City Hall, Paris, June 4; Fitzgerald, Sep. 10; for locomotion, Reckenzaun, Nov. 5-**7**; Faure accum., Pendleton, *Soc. Arts*, Dec. 14-**2**.

" STORAGE BATS., chem. of, *Eng.* Jan. 5; Brush, Feb. 23, Mar. 2; transport. of, Mar. 30-**3**; (secondary), Wilkins, July 4; July 25, Dec. 19-**4**; May 8; auto-accum., Jablochhoff, June 19; Nov. 13-**5**; Sep. 17-**6**; (sec.), lithanode for, Soc. Tel. Engs. Mar. 18-**7**; Lodge, *The Eng.* Jan. 5; Elwell accum. June 15-**3**; Drake, Sep, 10-**6**; reversible lead, Fitzgerald, Mar. 25, Apr. 8-**7**.

" STOVE, Sellons, *Sci. Am. Sup.* Apr. 18, Oct. 31-**5**.

" SWITCH-BOARDS, multiple, (2,400 lines), Kan. C. Teleph. exch. (1,000 wires), Lond. Telph. exch. *Elec. Rev.* Aug. 30-**3**; fittings, *Eng.* Feb. 5-**6**. See also TELEPHONE SWITCH-BDS.

" SYMBOLS, J. Munro, *Elec. Rev.* Oct. 1-**7**; *Eng.* May 15-**5**.

" SYNCHRONISM, *Fran. Inst.* Apr.-**5**.

" TELEMETRY, Hewitt, *Eng. News*, Apr. 25-**5**; instrum., Edgecomb, *Electric.* Dec.-**4**; Telemeter Co.'s instrums. *Elec. Rev.* Ap. 3-**6**.

" TELPHERAGE. See TELPHERAGE.

" TESTING, ap., Woodbury, *Mech.* May 12-**3**; do. portable, *Fran. Inst.* June-**3**; do. *Elec. Rev.* May 3-**3**; outfit, Irish's, *Elec. World*, Dec. 10-**7**; portable ap., Woodbury, *The Eng.* June 15-**3**.

" THERMOSTAT, F. C. Childs, *Soc. Arts*, Mar. 8-**3**.

" TIME, repeater, Oram, *Elec. Rev.* May 22; detector, Rosebrook, June 12-**6**; Lippmann, *Sci. Am. Sup.* Oct. 1-**7**. See also TELEPHONE TIME TRANSMISSON.

" TOOL, motor for shops, *Elec. Rev.* May 3-**3**.

" UNITS, *Eng. News*, Sep. 19-**5**; measurement, Barker, *Iron Age*, 12-**3**; and nomenclature, Nystrom, Dec. 18-**4**; Ohm, Rowland's det. of, July 30-**5**; *Mech.* June 21; Nystrom, Dec.-**4**; of measure, *Am. Eng.* Oct. 31-**4**; measurement, W. Thomson, *Van Nost.* May-**4**.

ELECTRIC UNITS, Watt and H. P., Preece, *Van Nost.* Dec.-**5**; mechan. explanation of, Crocker, *Electric.* Feb.-Apr; Joule's law anal., Buckingham, Mar.-**4**; and nomen., Jamieson, Sep.-**5**; equivs., C. Hering, May-**7**.

" UNITS, measurement, W. Thomson, *Elec. Rev.* June 7-**3**; Sep. 24-**7**; and value of, table, *Elec. World*, May 24; ohm, det. of, expts. Dec.13-**4**; Curtiss, Jan. 10-**5**; the ohm, F. W. Jones, Nov. 6-**6**; watt and H. P., relation between, Preece, *Sci. Am. Sup.* Nov. 29-**4**; ohm, legal, construct. of copies of, Oct. 24-**5**; May 28-**7**; *Eng.* May 9; ohm, det. of, Nov. 14-**4**; of measurement, W. Thomson, *The Eng.* May 25-**3**; watt and H. P., Preece, Sep. 19; Oct. 10-**4**.

" VALVE, Johnson, *Iron Age*, July 1-**6**.

" WELDING, E. Thomson, *Am. Eng.* Feb. 2-**7**; do. n. *Van Nost.* Nov.-**6**; do. *Fran. Inst.* May-**7**; Ries, and tempering metals, *St. Ry. Gaz.* Oct.-**7**; E. Thomson, *Elec. Rev.* Dec. 18-**6**; and tempering sys., Ries', Dec. 3; Bernardo-Ruhlmann, Dec. 17-**7**; E. Thomson, *Elec. World*, Dec. 25-**6**; July 9-**7**; E. Thomson, *Sci. Am. Sup.* Feb. 26, May 7-**7**; new art of, do. *Soc. Arts*, Dec. 9-**6**; do. *Eng.* Sep. 24-**6**; do. Jan. 7-**7**.

" WIRE, braider, N. E. Butt Co. *Elec. Rev.* Sep. 26-**5**; creeper, *Sci. Am. Sup.* Sep. 25-**6**; gauge and current capac., Edison standard, table, *Elec. World*, Feb. 5-**7**.

" WIRES. See also TELEGRAPH; TELEPHONE; TELPHERAGE.

" WIRES, H. P. of, Gordon, *Mech.* Mar. 8-**4**; insulator, glass, Nat. self-binding, *Electric.* May; distrib. thro. cities, E. Ries, Nov.-**5**; do. Feb, Apr; properties of copper, iron and german silver, Hering, July; joints,Haskins, Oct.-**6**; overhead sys. for cities, Flad, July-**7**.

" WIRES, insulator, Hamilton, *Elec. Rev.* Apr. 19-**3**; overhead ærial cables, Feb. 28; do. Macquairie, June 13-**5**; joints, Haskins, Sep. 4-**6**; carrying capac., Badt, May 7; overhead, prevention of dangers, Barrett, Sep. 24-**7**; do. insulating, Brooks, *Elec. World*, Apr. 24, May 1-**6**; joint, McIntire's, Aug. 13-**7**; H. P. of, *Eng.* Jan. 11-**4**.

" WIRES, UNDERGROUND. See also TELEG. WIRES, UNDERGROUND.

" WIRES, UNDERGROUND, subways, *Eng. News*, Sep. 11; do. manhole, N. Y. Oct. 23; Washington, Oct. 9-**6**.

ELECTRIC WIRES, UNDERGROUND, *Iron Age*, Aug. 6-5; Commiss. rep. *San. Eng.* July 8; (subway) tests of material, Ledoux, Sep. 9-6; in England, *Ry. & Eng.* Aug.-7; conduits, rep. on, *Fran. Inst.* Feb.-5; *Electric.* Aug.-3; cables, Waring sys., F. L. Pope, Dec.-4.

" WIRES, UNDERGROUND, Edison sys. *Electric.* Mar; Mass. R. Commiss. rep. May; Chicago, Haskins, Sep; Sep; Brooklyn, rep. Oct; Brooks, Dec; cables in Germany, Dec; Subway Commiss. rep., on Phil., Wash. and Chic. Oct.-Dec.-5; in England, Lain, Jan; Standard Undergr. Co. sys. Feb; for arc lighting, R. W. Pope, Mar; subways, N. Y. June; do. Commiss. rep. Aug; Brooklyn, Sargent, Nov.-6; effic. of, in cities, D. Brooks, Mar.-7.

" WIRES, UNDERGROUND, Lydecker, *Elec. Rev.* Mar. 29; expts., Chicago, Apr. 26; cable wks., Kerite, Oct. 11; for light, Morton, Dec. 20-3; July 18; Pennock, Sep. 12; cables, Benjamin, Sep. 19; cable, Okonite, Sep. 26, Oct. 24; N. Y. Elec. Subway Commiss. rep. Oct 24-5; do. May 8-6; Dorsett, Oct. 24-5; do. Feb. 13; Benjamin sys. Oct. 30-6; Sargent, Oct. 8; subways, N. Y. Dec. 3; conduit, Chenoweth, Dec. 10-7.

" WIRES, UNDERGROUND, sys. *Elec. World*, Oct. 11; Callender, Nov. 15-4; Am. Sectional Co's sys., rep. Feb. 14; in Paris sewers, Feb. 21; Contin. Union Cable Co. sys. Mar. 14; Elec. Tube Co's, Mar. 28, Apr. 4, 11; in Chicago, Apr. 18; Woodward's curb conduit sys. Apr. 18; Maquer's sys. Apr. 25; Brook's sys. June 20; Gilman's elec. subway, Aug. 29; Okonite Co's sys. Sep. 26; Stand. Undergr. Cable Co's sys. Oct. 24-5; Beere-Grant sys. Feb. 13; N. Y. rep. May 8; Macquairie, May 22; N. Y. Subway Commiss. rep. July 10; do. conduit sys. July 24-6.

" WIRES UNDERGROUND, Continuous Undergr. Cable Co's sys., Phil. *Sci. Am. Sup.* June 23-3; (teleg.) Jacques, *Soc. Arts*, Nov. 13-4; prog. in, do. Oct. 22-5; Edison lead connections, *The Eng.* Nov. 21-4.

ELECTRICIAN, what is an, Waldo, *Elec. Rev.* Oct. 29-7; first-Wm. Gilbert, *Sci. Am. Sup.* Sep. 13-4.

ELECTRICITY. See also ELECTRIC &c.

" Applied to explosives, Abel, *Eng. News*, July 7; U. S. Magnetic observ., Los Angeles, Cal. Aug. 18-3.

ELECTRICITY, recent uses of, *Iron Age*, Nov. 13-**4**; from wind power, Vienna Elec. exhib. *Mech.* Nov. 3-**3**; as a motive power, Forbes, *Van. Nost.* Aug; static and dynamic, relation of, Dec.-**3**; magnetism, theory of, Hughes, July; passage through gases, expts., Schuster, Sep.-**4**.

" SELENIUM CELLS, and bats., Fritts, *Van Nost.* May; electromotive action of illum. selenium, discov. by Fritts, W. Siemens, June; in warfare, Fiske, Dec.-**5**; thermo-elec., n. Sep.-**6**; production, Fiske, *Ry. & Eng.* Nov. Dec.-**7**.

" HALL'S PHENOMENON, *Fran. Inst.* Sep; as illum. agent in astron. obs. Sep.-**4**; in medicine, Apr; in warfare, torpedoes, Mar.-**5**; do. Jan, Feb; dynamic, development of, Mar; applic. to markmanship, July, Aug.-**6**; bk. n., Fleming, Jan; nature, n., Hering, June-**7**; as motive power, W. Wharton Jr. *St. Ry. Gaz.* Nov.-**7**.

" MECHAN. ENERGY, and equivs. *Electric.* Apr; from wind, util. Sep.-**3**; Brit. Assoc. pro. Oct.-**4**; atmospheric, Blake, May, Aug; do. Van der Weyde, Oct.-**5**; electromotive action, inverse, of voltaic arc, Cross, Sep; dynamic, C. Hering, Apr.-Dec.-**6**; nature, Miller, Jan; and gas, Graeff, May; dynamic, Hering, Jan.-Dec.-**7**.

" PROPULSION, for, *Elec. Rev.* Mar. 22; heat and light, Gray, Apr. 19; as motive power, Forbes, June 7; applic. to do. Buiswanger, July 5; applic. to working of coal mines, Bagot, Aug. 23; Fiske, n. Nov. 29-**3**; sources of (elec. bats.), Mar. 6; Oct. 11; marine, (elec. under sea), Beane, Nov. 22, 29-**4**.

" SOURCES, Tyndall, *Elec. Rev.* Mar. 7; distrib. of, Forbes; Mar. 14; Rogers, Sep. 5-**5**; in medicine, Apr. 3; ozone, hist., Van der Weyde, June 19, 31; transmission of heat into, Case ap. July 17-**6**; death by, D'Arsonval, May 28; motive power of circulation of blood, Stonex, June 4; gas into, Oct. 15-**7**.

" ELEVATED ROADS, for, N. Y., Farmer, *Elec. World*, Dec. 27-**4**; production by solar energy vs. coal, Fritts, Feb. 7; production from light, W. Siemens, Fritts, Apr. 25; in warfare, Fiske, Nov. 21, 28; static, P. Atkinson, July 4, 25, Sep. 26, Oct. 3, 31, Nov. 7, Dec. 5-**5**; do. Jan. 2, 16-**6**; what is it, Wolcott, July 2-**7**.

" DOMESTIC, *Sci. Am. Sup.* Jan. 13; atmos., origin of, Zehnder, Aug. 11-**3**.

ELECTRICTY, the great discovs. in, *Sci. Am. Sup.* May 17-4; do. July 14-4; and its applics., Fraser, *Sci. Am. Sup.* Sep. 6, 13; applics. to seismic movements, Sep. 20-4; as a motor, hist. n., M. G. Farmer, Jan. 17; sources of, Tyndall, Feb. 21, Mar. 14; and magnetism, Nipher, May 9; in warfare, Fiske, Dec. 19-5; hydrodynamic effects, Apr. 10; and magnetism, Aug. 7-6; and crystallization, Oct. 1, 22, Nov. 5, 12-7.

" APPLICS. to dust, *Eng.* Jnne 5; Antwerp exhib. June 19; July 10, 17-5; direct from fuel, Sep. 9-7; bk. n., J. T. Sprague, *The Eng.* Sep. 12-4; sources, Tyndall, Jan. 9-5; modern views of, Lodge, Nov. 4-7.

ELECTRO-CALORIMETER, *Elec. World*, Oct. 10-5; Roitis', *Sci. Am. Sup.* Nov. 14-5.

" CHEM. RINGS, *Sci. Am. Sup.* Feb. 21, 28-5.

" DENTAL AP. *Fran. Inst.* Mar.-5.

" DEPOSITION, of iron, Austin, *Electric.* Aug; of alloys, S. P. Thompson, Aug.-7; of carbon, etc., Gore, *Elec. Rev.* Sep. 13-4; of iridium on copper plates, J. M. Batchelder, *Soc. Arts*, May 22-4. See also METALLURGY.

" DYNAMICS, units, *Iron Age*, Jan. 22-5; do. *Mech.* Aug. 11, Sep. 8; do. Nystrom, Oct. 20; do. Nov. 10-3; do. Jan.-5; do. *Fran. Inst.* July; mach. Dec.-4; error in, Hooper, *Electric.* Mar.-6.

ELECTROLIERS, Brentwall's suspen. for, *The Eng.* Mar. 16-3.

ELECTROLYSIS, of silver and copper, Shaw, *Electric.* Apr.-7; desilverization of lead by, Keith, *Elec. World*, Sep. 20-4; precip. of copper by, Foote, Mar. 7-5; arr. of vats for, Slater, May 1-6; Sommer, *Sci. Am. Sup.* June 16-3; Schucht, June 14-4; secondary, Semmola, July 31-6; Brit. Assoc. *Eng.* Sep. 16-7; bk. n., Fontaine, *The Eng.* Mar. 6; commercial, Higgs, Feb. 6, Apr. 17, June 12, 26, Aug. 28-5.

ELECTROLYTIC COPPER REFINING, *Eng.* July 3-5.

ELECTRO-MAGNETS, construct., Du Moncel, *Van Nost.* Jan–Mar; winding of, Dec.-3; largest, *Electric.* Mar.-3; J. T. Sprague, May-4; Currie, *Elec. Rev.* Feb. 21-5; Recordon, *Eng.* Jan. 1-6. See also ELECTRIC DYNAMOS.

" MAGNETIC mach. tools, Rowan, *Am. Eng.* Sep. 14, 21-7; do. illus. *Elec. World*, June 25-7; do. *Sci. Am. Sup.* Sep. 3-7; locomotive, early, *Elec. Rev.* Mar. 14; eng. of 1884, Aug. 22-5; induction, Heaviside, July 23-7; drilling and riveting machs. *The Eng.* June 3-7.

ELECTO-MAGNETISM, discov., Lutteman, *Elec. Rev.* Jan. 9-**6**; and hydro-dynamics, *Eng.* Oct. 26, Nov. 2-**3**.

" MEDICAL AP., bats., rep., *Fran. Inst.* May-**6**; *Elec. World*, Nov. 1-**4**.

" MEGALOSCOPE (medical), *Elec. Rev.* Feb. 13-**6**.

" METALLURGY, *Fran. Inst.* Feb.-**5**.

ELECTROMETER, quadrant, W. Thomson's, *Mech.* Feb. 23-**4**; do. *Eng.* Dec. 28-**3**. See also ELECTRIC GALVS.

ELECTROMOTIVE action of illum. selenium, Fritts, *Fran. Inst.* June-**5**.

ELECTRO-MOTORS, *Sci. Am. Sup.* Sep. 6-**4**.

" PLATING. with nickel, *Fran. Inst.* Feb, Mar.-**4**; dynamos, E. P. Thompson, *Elec World*, Jan. 10-**5**; silver, electrolytic balances of chem. corrosion, Gore, *Sci. Am. Sup.* Apr. 21-**3**; with nickel. Wahl, May 10-**4**.

" PNEU. transit sys., Clay, *Mech.* Oct.-**7**; valve, Johnson's, *Elec Rev.* May 2-**5**.

" TECHNICAL INST., Montefiore, Belgium, *Elec. Rev.* Oct. 18-**4**.

" TECHNICS, at Vienna exhib. *Elec. World*, Aug. 23, 30-**4**.

" -TYPING, *Sci. Am. Sup.* May 9-**5**; dynamo, Elmore, Sankey, *Eng.* Feb. 20-**5**.

ELEVATORS, hydr. and motors, B. F. Jones, *Eng. News*, June 9-**3**; safety attach., Clem & Morse, *Iron Age*, Nov. 8-**3**; most econ., Magovern, Mar. 3; bbl. and package, Roller Chain Belting Co., Ohio, Nov. 17-**7**; hydr. and stm., effic. of, *Mech.* Feb.-**5**; hydr., Otis', hush valve for, R. C. Smith's, *San. Eng.* Apr. 29; hydr. lifts, Mersey Ry. tunnel, Rich, Oct. 30-**6**; Equit. L. Ins. Co., N. Y. *Eng. & Bu. Rec.* Nov. 5; most econ. Magovern, Dec. 3-**7**.

" STOKES, *Am. Eng.* Jan. 11; for fibrous material, Link Belt Co. Jan. 25; Whittier, Dec. 12-**4**; hydr., undergr. station, Mersey Ry., Liverpool, Rich, June 30-**6**; and hoisting engs., Lidgerwood, *Ry. Gaz.* Mar. 20-**5**; hydr. and motors, B. F. Jones, *Sci. Am. Sup.* July 7-**3**; great street, Stockholm, Sweden, Apr. 26-**4**; helicoidal, Sep. 10-**7**.

" LARGE, Weaver r. *Eng.* Sep. 12-**4**; hydr., Otis, Apr. 17; hydr. Inv's exhib., Ellington, May 1; do. Am. Co. May 8; Attwood, Inv's exhib. May 15; hydr. (hoists), Oct. 16-**5**; hydr., Bennett, Sep. 17-**6**; econ. of, May 27-**7**; hydr. lifts, cyclic, Hart's, *The Eng.* Jan. 26-**3**.

ELEVATORS, Am. Elec. Co. *The Eng.* June 27-**4**; hoists and lifts, Attwood's, May 15; Stevens & Majors lift, Oct. 9; Butler's endless chain (for materials), Dec. 25-**5**; hydr. pass., Mersey Ry., Rich, May 14-**6**.

ELLIPSE DRAWING, Smith, *Power & Trans.* Mar.-**7**.

EMBROIDERING MACHS. *Sci. Am. Sup.* Aug. 7-**6**.

EMERY, wheels, *Iron Age*, Apr. 2-**5**; do. solid, May 20-**6**; do. and files, commercial value, Aug. 25-**7**; grinding rooms, Yale and Towne Mfg. Co. May 31-**3**; do. *Mech.* May 12-**3**; wheels and mach., Roper, *Van Nost.* Feb.-**5**; wheel fitting shop and files, relative econ. *Ry. Gaz.* May 27-**7**; wheels and mach., Roper, *Sci. Am. Sup.* Mar. 28; mines of Asia Minor, Stevens, rep. Nov. 28-**5**; wheels, solid, Paret, Apr. 24-**6**.

EMPLOYERS liability in Europe, *Iron Age*, Oct. 28-**6**.

ENGINES. See also AIR ENGINE; MARINE ENGINES; RAILROAD LOCOMOTIVES; PUMPING ENGINES; STEAM ENGINES.

" HYDRAULIC, aut. tug, *Mech.* May-**5**; arr., pneu., Tasker, Nov.-**7**; caloric beam, for fog signaling, *Iron Age*, Oct. 6-**7**; caloric, "Victor," *Mech.* Aug.-**5**; do. beam, Pulsometer Eng. Co. *Eng.* Jan. 14-**7**.

ENGINEER, and wage earner, *Iron Age*, Sep. 24-**5**; some often neglected duties of the, Collingwood, *San. Eng.* June 24-**6**; as an economist, Towne, *Am. Eng.* June 17-**6**.

ENGINEERS, Amal. Soc. of, England, *Eng.* June 29-**3**; and architects, *Eng. News*, Jan. 9-**6**; Club, Phil., pro. May 31-**4**; hand books, Trautwine, *Am. Eng.* Apr. 10, 24-**5**; duties, addr., Collingwood, *Van Nost.* Aug.-**6**; education of, *Ry. Gaz.* Jan, 26, Feb. 9-**3**; stationary, exam. of, *Iron Age*, Feb. 21-**4**; Stationary, Nat. Asso. pro. *Sta. Engineer*, Sep.-**7**.

ENGINEERING. Including BUILDING, CIVIL, MECHANICAL, and MUNICIPAL ENG. See also BRIDGES; BUILDING; ELECTRIC; HARBOR; MARINE; MILITARY; TELEGRAPH; WATER WKS.

" REVIEW of year '82, *Eng. News*, Jan. 6; projects, foreign, Feb. 3; Quarterly, list articles in, Mar. 10-**3**; 10 years record, Apr. 19-**4**; union library, Feb. 7; water jet, chronol. of, Feb. 14; coffer-dam, floating, E. F. Smith, Mar. 14; map reprod., photographic, Davanne, May 9; prog., Bolier, June 27; do. Graff, July 4; profession of, Kent, Aug. 29; periodical lit. index, files to Oct. 3-**5**.

ENGINEERING, concrete vs. brickwork, *Eng. News*, Jan. 2; in war-times, Jan. 30; cals., short cuts, June 5; duties, Collingwood, June 19; one year of, Flad, sup. July 3, 17; Am. Acad. of, proposal for, Kent, Oct. 16-**6**; failures, Apr. 9; union library, Apr. 16; bridge stresses, cal., n. May 7; do. cantilever principle, n. June 11; do. dimensioning meth., Ottewell, June 11; do. Stowell, Sep. 3-**7**.

" ESTABLISHMENTS, arr. of, Hutton, *Iron Age*, Feb. 22-**3**; Japanese, July 29; accidents, Sep. 9-**6**; estimating, *Mech.* Jan. 6; estabs., arr. of, Hutton, Feb. 3; shop records, Schleicher, Mar. 24-**3**; concrete in foundations, Mar. 8; contractors time book, May 10-**4**; manuf. wks. correspondence card, Jan.-**6**; strength of materials, Howard, July; index, Sep.-**7**.

" FREEZING through quick sand, *Am. Eng.* June 27-**4**; strength wrt. iron cols. Apr. 17; exploration outfit, Fielding, May 15, 22; strength materials, tests, Pike, Sep. 10; cols., crushing limit of, n. Dec. 17-**5**; pats., files from Jan. 1-**6**; and architecture, *San. Eng.* Nov. 27, Dec. 25-**6**; do. Jan. 1–29, Feb. 5–19, Mar. 5, 12, 26, Apr. 9, 30, June 4, July 2, Aug. 13-**7**; do. line of demarkation, J. M. Wilson, *Eng. & Bu. Rec.* Nov. 5-**7**.

" MASONRY, and carpentry of Greeks and Romans, *Van Nost.* July; long col. formula, Robinson's, Burr, Nov; force, definition, Nov; arches, proportions of, from French practice, Gould, Dec.-**3**; and science, Jan.-**4**.

" SCIENCE and practice of, Kennedy, *Van Nost.* Jan; strength materials under repeated stress, Merriman, Feb; true gravimetric constant, Clark, Mar; inventions since 1862, Bramwell, Mar, Apr; instrums., planimeter, Coradi, Elliott, June; as a profession, Kent, Aug; and architecture, relations between, Goldstraw, Sep.-**5**.

" PROGRESS, Nursey, *Van Nost.* Apr; achievements and reward, Buchholz, Aug; Am. Acad., proposed, Kent, Oct; long cols., flexure and resist. of, Hoskin's, Nov.-**6**.

" TECH. EDUCATION, *Fran Inst.* Jan; and indus. prog., an. summary, '84, Feb.-**5**; do. '85, Apr.-**6**; do. Feb; long cols., n., Cain, July, Aug.-**7**; Am. assocs. *Ry. Gaz.* Mar. 30-**3**; prog., '84, July 3; instrums., Corandi polar planimeters, Amsler, Aug. 14-**5**; util. of natural forces, *Elec. Rev.* Aug. 23-**3**.

ENGINEERING, WKS., important, Brunlees, *Sci. Am. Sup.* Feb. 24; rhymes, Bayles, Apr. 7; sand foundations, movement of, Forchheimer, Apr. 7; stresses in frame works, Graham, Sep. 15-**3**; the wall (ancient walls &c.) T. R. Smith, Dec. 6-**4**.

" INSTRUMENT, rolling planimeter, Reitz, *Sci. Am. Sup.* Apr. 25; invs. since 1862, F. J. Bramwell, May 9, 15; sustaining walls, July 18; prog. in '84, July 18; piles, the destroyers of, Oct. 31; instrum., the integraph, Nov. 7-**5**.

" SHAFT sinking thro. quick sand, *Sci. Am. Sup.* Feb. 13; practice, ethics of, Bayles, Feb. 27; materials, concrete, Slater, May 1; prog., Flad, Sep. 25; tendencies, Coxe, Nov. 13-**6**; angles, laying off, *Locom.* Jan.-**3**; strength materials, J. E. Howard, May-**7**.

" METAL TRADES EXHIB., and, *Eng.* July 6–20-**3**; wks., Cornwall, Tangyes, Birmingham, Sep. 5; tech. training, Elgar, Sep. 12-**4**; subaqueous blasting June 26; strength materials, Brit. Assoc., Baker, Sep. 25-**5**; notes, files, 1883-**7**.

" PROG., '82, *The Eng.* Jan. 5; rhyme, Bayles, Mar. 23; graphics, cals. by drawing lines, R. H. Smith, June 15, 29; spherical tower, Aug. 10; iron wk. des., spec. and inspection, Pendred, Oct. 5; Escher wks., Zurich, Nov. 23, 30; shaft sinking thro. quick sand, Poetsch's sys. Nov. 30; Soc. of, pro. Nov. 30, Dec. 21-**3**; '83, Jan. 4; Soc. of, pro. Feb. 8, 15; frame work, graph. treatment of stresses in, Graham, Feb. 8, June 20; graphics, or cal. by drawing lines, R. H. Smith, Mar. 7; science and practice, Kennedy, Oct. 31-**4**.

" REVIEW OF '84, *The Eng.* Jan. 2; Am. enterprise, Rigg, Mar. 6, 13; autographic stress and strain diagrams, Unwin, Aug. 28-**5**; prog., '85, Jan. 1, 8; wks., sys. in, Renold, Dec. 3; resist. of materials to repeated loads, Unwin, Dec. 10; struts, Ayrton, Dec. 10-**6**.

" PROGRESS, '86, *The Eng.* Jan. 7; resist. of materials, Unwin, Jan. 7; measuring instrum. for mechan. testing, May 20; stresses in a camp stool, notes, Aug. 5–26; extension, elastic, a species of motion, R. H. Graham, Aug. 19, Sep. 2; struts, strength, W. H. Smith, Sep. 2, 9, Oct. 14, 28; do. strength and stiffness, R. H. Smith, Nov. 25-**7**.

" BUILDING, sand, movement of, Forchheimer, *Eng. News*, Mar. 3; stones, use of, Gowans, Mar. 24; public buildings, means of egress, July 14-**3**.

ENGINEERING, BUILDING, brick, standard, Switz., Fayod, *Eng. News*, Dec. 15; stones, decay of, Dec. 15-**3**; do. of Chicago, Jenny, Jan. 5; buildings, raising and moving, in Am. Feb. 9; concrete, for farms, May 31; brick masonry beton floors, resist. expts. July 12; Mut. Life bu., N. Y., hoisting and heating plant, Aug. 2; material, cork as a, Wagner, Oct. 4; brickwork, saltpetre, exud. upon, Nov. 15-**4**; do. *Am. Arch*; bricks of glass sand, *Eng. News*, Nov. 29-**4**.

" BUILDING, roofs, concrete, Payne, *Eng. News*, May 2; Church of Sacred Heart foundations, Montmartre, Paris, May 9; St. Peters, Rome, hooping of dome, May 16; brickwork, Rankine, May 16, 16; buildings, public, list, Aug. 1; mat., mortars, Sep. 12; dangerous, Gamble, Sep. 26; material, Aberdeen granite, Sep, 26-**5**.

" BUILDING, construct. in earthquake countries, Milne, Apr. 3; nails, tenacity of, Apr. 24; roofs, glass, n. July 24-**6**; mat., mortars, effect of adding saccharine matters to, Crompton, Jan. 1; roofs, supports, masonry arches as, Tiedemann, May 14; flooring, steel, Lindsay, Nov. 26-**7**.

" BUILDING, roofing, *Iron Age*, Feb. 22-**3**; sand, sharp, and quicksand, *Mech.* Nov. 17-**3**; bricks, sizes, Apr. 19-**4**; brickwork, permiss. strain on, May; crushing strength of, Nov.-**5**.

" BUILDING, Nat. Agric. Hall, London, *Am. Eng.* Sep. 3; brick walls, efflorescence of, C. J. Anderson, Dec. 24-**5**; cyclorama, Gettysburg, *Eng. & Bu. Rec.* Nov. 19; opera house requirements, Adler, Nov. 26; Nat. bu. & Custom h. requirements, Bell, Dec. 3-**7**; roofing, joint, water-proof, Cin. Corrug. Co. *Ry. Gaz.* May 29-**5**.

" BUILDING, walls, damp, *Van Nost.* Apr; public, pillar tests, U. S. govt. Aug.-**3**; long col. formula, Burr's criticisms, Robinson, Apr, May; do. n. Burr, Aug; stone wk., formula for cal. pressures in, Gould, Aug; Albany, N. Y., Capitol, foundations of, McAlpine, Sep; roofs, truss, wood, Sep.-**4**.

" BUILDING, inspection of metallic structures, Sanderson, *Van Nost.* Apr; iron wks. in, ornamentation, Julian, Apr; structural des., general, Burr, May; Roman construct., Oldrieve, Sep.-**5**; do. *Bu. News*; materials, resist. to frost, *Van Nost.* Jan; brickwork, permiss. strain on, Bohme, Mar; mat., white pine, bricks and stone, strength of, n., Pike, June; concrete, Slater, June-**6**; do. *Eng. & Bu. Rec;* do. *Bu. News.*

ENGINEERING, BUILDING, material, mortars, effect of adding saccharine matter to, Crompton, *Ry. & Eng.* Jan.-**7**; do. *The Sci. Am.*3, 10-**6**; material, beton and iron as, *Fran. Inst.* Aug. -**3**; sustaining walls, *Sci. Am. Sup.* Feb. 26; buildings, galvanized steel plate, Nov. 5-**7**; bridge and warehouse flooring, *Eng.* Aug. 19-**7**; Agric. Hall, Kensington, roof cals. *The Eng.* Nov. 19-**6**. See also BUILDING.

" CIVIL. See also BRIDGES; CANALS; DAMS; ENG., MUNICIPAL; PAVEMENTS; RAILROAD; ROADS; SEWERAGE; TUNNELS; WATER WORKS, ETC.

" CIVIL, Am. Soc., Engineers, pro. *Eng. News*, Jan. 20; Feb. 10; May 26. June 9, 16, 30, July 7, 21, Dec. 8-**3**; Mar. 1, Apr. 26, May 10, 24, 31, June 14-28, Nov. 22, Dec. 20-**4**; Jan. 24, 31, Feb. 21, 27, Mar. 14, June 13, July 4-**5**; Jan. 9, 23, Apr. 10, June 5, July 24, Aug. 7, Oct. 23, membership, Nov. 27-**6**; Jan, 22, growth, Jan. 29; Feb. 5, Mar. 5, Apr. 9, June 4, black-balling, June 18, map showing distrib. of, July 2-22, Aug. 13-27, Sep. 10, 17, Oct. 15-**7**.

" CIVIL, Am. Soc. pro., *Mech.* May 24, Nov.-**4**; *Am. Eng.* June 13, 13, 20, Nov. 14-28-**4**; Jnly 3, 10-**5**; July 7-**6**; July 13, 20-**7**; *San. Eng.* July 2, 16, 23-**5**; Jan. 28, July 15-**6**; July 9, 16-**7**; *Ry. Gaz.* June 20-**4**; July 3-**5**; July 30-**6**; July 8, reorgnization of, Oct. 14-**7**; *Eng.* July 31-**5**; Feb. 26, Apr. 30, Aug. 13-27, Sep. 3, 10-**6**; Mar. 11, Apr. 1, Aug. 19, 26, Sep. 16-**7**.

" CIVIL, Institution of Engineers, pro. *Eng. News*, Jan. 12, June 7-**4**; hist. sketch, Oct. 30-**6**; addr., Bazalgette, *Van Nost.* Apr.-**4**; *Eng.* Jan. 12, Apr. 6-**3**; Jan. 11, May 9-**4**; June 12-**5**; Apr. 2, May 28-**6**; *The Eng.* Jan. 19, Dec. 7, 14-**3**; Jan. 18, Feb. 1, 8, Mar. 7, 21, 28, Apr. 4, May 30, June 6-**4**; Jan. 16, 30, Feb. 20, Mar. 20, Apr. 10, 24, May 29, June 12, Sep. 25, Nov. 13, 20-**5**; June 4-**6**; Apr. 11-27, May 11, 25, June 15, July 13, Nov. 11, 18 **7**.

" CIVIL, Institution of Ireland, *The Eng.* Apr. 3-**5**.

" CIVIL, and Surveyors, Ohio Soc. pro. *Eng. News*, Jan. 31-**5**; Jan. 23-**6**.

" CIVIL, Societies, Paris, pro. *Eng. News*, Feb. 9, May 3-**4**; in U. S. July 11-**5**.

" CIVIL, Worthing local board spec., England, *Eng. News*, Dec. 15-**3**; Aarberg base line, Switz., measurement and ap. of Ibauer, Specht, Mar. 22-**4**.

ENGINEERING, CIVIL, Engineers dept., Wash., rep. *Eng. News*, Jan. 10; Trautwine's pocket bk. Feb. 14-**5**; and architecture, what civilization owes, Bramhall, *Sci. Am. Sup.* Oct. 17-**5**; sand, thrust of, expts., Siegler, Sep. 3-**7**; at Inv's exhib. *Eng.* July 3, 10, 31-**5**; description of a, Tredgold, *The Eng.* Apr. 6-**3**.

" CIVIL, city engineers hand bk. *Eng. News*, July 26-**4**; culverts, box, max. spans of, July 25-**5**.

" CIVIL, dimensions meth. *Eng. News*, July 2, 10, 23, 30, Aug. 13, 20-**7**; do. Weyrauch, *Van Nost.* Oct. Nov.-**3**; ditch imps., apportionment of cost of, Opdycke, *Eng. News*, Jan. 24-**5**.

" CIVIL, earthwork, slopes, *Eng. News*, Mar. 14-28, Apr. 11-25, May 9, 16-**5**; shrinkage expts., May 1, 8-**6**; do. do. of clayey soils, Apr. 2; computation from diagrams, Sep. 3-**7**; S. B. Fisher, *Am. Eng.* Oct. 1-**5**; cal. *Ry. Gaz.* May 28-**6**; shrinkage, *Van Nost.* Dec.-**5**; do. Flynn, *The Eng.* July 23-**6**.

" CIVIL, education, Waddell, *Eng. News*, Jan. 1; Jan. 15, Feb. 5, 19-**7**; Vose, *Van Nost.* Mar.-**3**; do. *Sci. Am. Sup.* Jan. 20-**3**.

" CIVIL, embankments, sand-bag, *Eng. News*, Oct. 24-**5**; Vyrnnwy reps. June 19-**6**; exam. papers, N. Y. munic. service, Jan. 10, 24-**5**; do. *Sci. Am. Sup.* Oct. 2-**6**.

" CIVIL, EXCAVATION, great cut, France, *Eng. News*, July 19; plant, Carson, Oct. 25-**4**; and embankment by water power, Dorsey, *Sci. Am. Sup.* July 24-**6**; in soft materials, freezing proc. for, Sooysmith, *Ry. & Eng.* May-**7**; do. *Soc. Arts*, Jan. 27-**7**. See also ENG., CIVIL, Trench Mach.

" CIVIL, fees of, *Eng. News*, May 1-**6**; field wk., elimination of errors in, Bouton, *Van Nost.* Aug.-**6**; foundations, deep, *Eng. News.* July 18-**5**; do. in 300 ft. water, Jandin, Paris, Feb. 27; do. sand as, Curtis, May 15; do. sand, May 29-**6**; do. subaqueous, *Iron Age*, Feb. 4-**6**; do. do. new substance for, Gaetner, *Van Nost.* May-**6**; do. air locks and shaft tubes construct., Brennecke, *The Eng.* May 7-**6**.

" CIVIL, GEODETIC, operations, Pumington, *Eng. News*, Oct. 20-**3**; Assoc. of Europe, internat. Sep. 27-**4**; operations, Norwegian, *Van Nost.* Apr.-**3**; wk., U. S., Boutelle, July-**6**; do, *Science;* do. do. Mason & Dixon, Gore, *Ry. & Eng.* Mar; do. Borden's Mass. survey, Apr; U. S. lake survey, May; U. S. coast survey, June; wk., U. S., Gore, July, Aug.-**7**; operations, *Eng.* Sep. 14-**3**.

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" PARIS, Ry. Jubilee, '87, *Am. Eng.* Mar. 16-**7**; '89, and 1,000 ft. tower, *Sci. Am. Sup.* Aug. 14-**6**; '89, mach. palace, May 21-**7**.

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" RISKS of elec. lighting, Hedges, *Eng. News*, Nov. 17-**3**; appliances, Dunham, Apr. 26-**4**; hydrant, Greathead injector, Feb. 20-**6**; precautions, May 14-**7**; hand grenades, *Iron Age*, Oct. 23-**4**; ins., mut. Mar. 26; sprinklers, June 18; hand grenades, Nov. 19-**5**; hydrant, Gaskill, Mar. 11; hand grenades, Apr. 29-**6**; extin. sprinkler tests, *Am. Eng.* Jan. 5-**7**.

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" FIRE-PROOF bu. in N. Y. *Sci. Am. Sup.* June 20; do. plastering, G. H. Hunt, Aug. 29; from stm. pipes, n. Sep. 5; extin. perpetual (chemical), Oct. 31; doors in mills, Hexamer, Dec. 19-5; addr., Hoadley, Jan. 30, May 8; eng., floating stm., Zophar mills, Aug. 21-6; loss, U. S. *Sta. Eng.* Sep.-7; aut. sprinklers for protect. against, Woodbury, *Soc. Arts*, May 21-5; alarm, Martin-Wilson aut., Kendall, May 12-7.

" ALARMS, Elec. exhib. Vienna, *Eng.* Nov. 9-3; injector hydrant, Greathead, Jan. 11; do. elec., Bright, Feb.15-4; sprinklers, aut. tests and expts., Woodbury, Jan. 2, 16, Feb. 6; fireproof doors, May 22; sprinklers, aut. June 26-5; escape, Edmunds, Jan. 22; eng., floating, Merryweather, June 18-6.

" FLOAT, "Seth Low," Brooklyn, *Eng.* Jan. 7; boats, Cowles, Jan. 14; and elec. burglar alarm, Taussig, Mar. 25; extin., stm. for, Oct. 14; peculiar origin of fires, Dec. 2-7; London fires, *The Eng.* Mar. 2; risks of elec. lighting, Hedges, Oct. 12-3; fires in theatres, Jan. 25; eng., stm., Shand, eng. Aug. 15; do. raft, Sep. 26; sprinkler, Grinnell aut. Oct. 3; risks in London and N. Y. Oct. 3-4; London fires, Jan. 30, Feb. 11-7.

FIRE-BRICK MANUF., Mt. Savage, Md. *Eng. News*, Apr. 10-6; do. *Iron Age*, Apr. 15-6; do. Anderson, *Sci. Am. Sup.* Apr. 24-6; fire-bricks, Dent, *Am. Eng.* Nov. 9-7.

FISH curing and cooking plant, Leach's, *The Eng.* May 25-3.

FISHERIES, Exhib., London, *Sci. Am. Sup.* May 19; Am. exhibits, July 14; U. S. at, Nov. 17, 24-3; *Eng.* Feb. 9, May 4; mach. at, May 18-3.

FISHERIES, Exhib., life saving ap. *Eng.* May 25; stm. trawler, June 1, 8; models, July 27, Aug. 10, 24, 31; U. S. stat., '80, Sep. 14-21; English and Am. Sep. 28; U. S. at, Oct. 5; Oct. 19, 26, Nov. 2-23, Dec. 7, 28-3; *The Eng.* Feb. 9, May 11-3.

FISHERY, Menhaden, in U. S. *Eng.* July 6-3; trawl winch, *The Eng.* Sep. 21-3.

FLAD, HENRY, por. *Eng. News*, July 3-6.

FLANGING MACH., Bassett, *Iron Age*, Aug. 7-4.

FLAX, cultivation, U. S. *Fran. Inst.* May-6; breaker indus. *Sci. Am. Sup.* Oct. 8; scutching mach. Nov. 26-7.

FLORIDA, gulf coast of, Levis, *Sci. Am. Sup.* Feb. 10-3.

FLOUR, what the baker can get out of a bbl. of, *Sci. Am. Sup.* Nov. 22-4; packing in bags, ap., Koellner, Dec. 5-5.

FLOUR MILL, anal. *Am. Eng.* Dec. 3-5; at Malters, Switz. *Sci. Am. Sup.* Nov. 24-3; Beyer's porcelain cyl. Aug. 30-4; Am. roller milling, M. W. Clark, Sep. 5; roller, power lost by friction in, Muller, Nov. 14-5; wind-mill, Aug. 13; roller milling, H. Simon, Sep. 10; milling, Oct. 22-7.

" MILL, gigantic, Porta Costa, *Eng.* Sep. 21-3; Albert bridge, Battersea, July 11, Sep. 19, Oct. 3-4; roller, Covinto, Chili, Apr. 24; milling exhib., Paris, June 5, 19, July 3; mach., Buiscough, Hind, Sep. 4, 18-5; do. Manchester, Sep. 3; mills, Liverpool, Nov. 19-6; roller milling, Simon, July 8-7.

" MILLS, Greenwood's, Blackburn, *The Eng.* Jan. 16; vertical engs., Wolverhampton, Nov. 20; Phœnix mills, Newcastle-on-Tyne, Carter, eng. Dec. 11; roller milling sys. Dec. 11-5; roller, Bombay, Simon, eng. June 18, 25; the modern, Dec. 17-6; mach. Dec. 17-6; do. Apr. 22; Brit. milling trade depression, June 17; roller mills, power consumed by machs. in, tests, Simon, July 8, 15, 15; modern milling, Little, Aug. 26, Nov. 18-7.

FLYING, mach., engs., Russia, Ahrbecker, *Mech.* Mar. 31-3; air, nav. of, R. Thayer, *Am. Eng.* May 22-5; do. *Sci. Am. Sup.* Oct. 4; mach., Brearey's, Dec. 13-4; expts. Jan. 8-7; flight of birds, Lancaster, *The Eng.* Mar. 2; Lancaster, May 18, June 22, Aug. 3, 10, Sep. 21-3; air, nav. Aug. 29-4. See also AIR NAVIGATION.

FOG ILLUMINATION, theory, Physical Soc. *Eng.* May 1-5.

FOG SIGNALS, *Iron Age*, Jan. 6-7; ap., Buckett caloric eng. and siren, *Mech.* Apr. 14-3; whistle operator, Sonnebula, Durham, *Eng.* Feb. 20-5; June 24-7.

FOODS, economic consumption of, tables, *San. Eng.* Dec. 4-6; inorganic *Fran. Inst.* Sep; fatty, Oct.-6; and nutrition, chem. of, Atwater, *Soc. Arts*, Apr. 22-6.

FORESTS, climatic influences of, *Eng. News*, June 6; forestry in Europe, July 18-5; and floods, Roberts, *Am. Eng.* Apr. 11-25, May 2-30, June 6-4, rotation, Campbell, *Sci. Am. Sup.* Jan. 8-7; laws, U. S. *Eng.* Oct. 23-5.

FORGE, Tubul Cain, the father of, *Mech.* May 10-4; smiths, Homick Ry. wks. *The Eng.* Sep. 23-7.

FORGING heat developed in, *Iron Age*, Nov. 22-3; do. Tresca, *Mech.* Nov. 17-3; Aug.-4; smith wk. *Sci. Am. Sup.* Apr. 16-7; gasolene vapor for forges, *Eng.* Nov. 27-5.

FOUNDATIONS. See BUILDING; ENG., BUILDING, FOUNDATIONS.

FOUNDRY, Bouton Co. *Iron Age*, Apr. 28-7; hydraulics, Radcliff, *Mech.* Feb, 16, Mar. 22-4; wks., Hopson & Chapin Mfg. Co. Nov. 5; sand moulder, Rice, Dec.-6. See also IRON AND STEEL.

FRANCE, mineral stat. for '83, *Iron Age*, June 4-5; crown diamonds, ap. for exhibiting, *Sci.Am. Sup.* Sep. 20-4; postal and teleg. service, *Eng.* Aug. 29-4; trade, '86, consular rep. *The Eng.* Apr. 1, 8-7.

FRANCIS, JAMES B., por. *Eng. News*, Jan. 1-7.

FRANKLIN INSTITUTE, Phila., programme of lectures, *Am. Eng.* Oct. 29-5; bks. in library and pro. *Fran. Inst.* files, Jan.-3-Dec.-7; Novelties exhib. rep. Aug.-Dec-6; an. meeting pro. Feb.-7.

FRICTION, of hydr. cupped leather packing, St. Louis, *Eng. News*, May 14-7; of bearings, expts., Tower, *Iron Age*, Feb. 14-4; journal bearings, anti-friction, Jan. 22-5; expts., Tower, rep. *Mech.* Feb. 2, 9-4; nature of, *Van Nost.* Apr; sliding, of rotation, Thurston, Dec.-4; of solids, Hele-Shaw, *Sci. Am. Sup.* Dec. 18; fluids, Dec. 25-6; coil, Suplee, *Power & Trans.* Mar.-6; of bearings, expts. *Eng.* Nov. 16-3; expts., Tower, Feb. 6-5; what is friction, *The Eng.* Feb. 22-4. See also ENG., MECHAN., FRICTION AND LUBRICATION.

FRY, HOWARD, *Mech.* May 26-3; *Ry. Gaz.* May 4, 11-3; por. *Sci. Am. Sup.* June 2-3.

FUEL, powdered anthracite and gas, *Eng. News*, Nov. 13-**6**; econ. *Iron Age*, Dec. 6-**3**; dust, Perret's, Dec. 10-**5**; calorific power of, Feb. 4-**6**; calorimeter, Schwackhofer, Sep. 10-**5**; do. *Mech.* Sep.-**5**; econ. Dec. 8-**3**; artif. mach. May 3; do. France, June 28-**4**.

" GASEOUS, Sutherland, *Am. Eng.* June 20-**4**; fluid and solid, relative costs, n. July 10; do. Beatty, Oct. 29-**5**; calorific power of, W. Thomson, July 7; dust, July 28; combust. and practical requirements, F. Siemens, Oct. 27-**6**; calorific power of, Sakurai (Japan), *Van Nost.* Feb; combust., F. Siemens, Dec.-**6**; controlled combust., expt. principles of, *Fran. Inst.* Jan.-**3**; heat of combust. of coal, July-**4**.

" GASEOUS, L. T. Wright, *Sci. Am. Sup.* Mar. 8-**4**; fluid and solid, rel. costs, Beatty, Nov. 7-**5**; combust., F. Siemens, Nov. 27-**6**; calorimetry, Thwaite, Jan. 15; and smoke, Lodge, Mar. 19, 26-**7**; of future, Wardman, July 11-**5**; do. *Pop. Sci. M*; evap. values, *Locom.* May-**3**; do. Apr; compar. value different coals and woods, tables, *Locom.* Apr.-**6**; calorimeter, dust, Perret, *Eng.* Oct. 23-**5**; Nov. 12-**6**; do. Schwackhofer's, *The Eng.* July 10-**5**; and smoke, Lodge, May 28, July 23-**6**; combust. Aug. 19-**7**. See also COAL; FURNACE.

FURNACE. See also FUEL; RAILROAD LOCOM. FIRE BOX, FURNACE; MARINE BOILER FURNACE; STEAM BOILERS, ETC.

" GAS, Henderson, *Iron Age*, June 7, 28; gases, ap. for anal. of, July 12; controlled combust., Marlett sys. July 12; smoke prevention, Oct. 18-**3**; Orvis smokeless, Oct. 2-**4**; chimney gases, Feb. 5; stm. as aid to combust. in, Apr. 23; grate and heating surface, Nov. 26; dust fuel, Perret's, Dec. 10-**5**; Krudewig smoke-preventing, Jan. 21-**6**.

" REGEN., heating by radiation, Head, *Am. Eng.* Feb. 20-**5**; draught gauge, *Fran. Inst.* June-**5**; Cowles reduction, for ores, rep. July-**6**; gases, Bunte's ap. to determine, *Sci. Am. Sup.* July 14; gas furnaces, flame distrib. in, Aug. 4-**3**; regen. gas, meth. of heating, F. Siemens, Jan. 17-**5**; combust., fire, addr., Hoadley, Jan. 30, May 8-**6**.

" GAS, Siemen's direct proc. *Eng.* Jan. 5; mechan. stoker, Sinclair's, Jan. 19; gas, retorts, Siemen's regen. sys. Jan. 19; crucible, Piat's, Feb. 16, 23-**3**; regen. gas, Dec. 19-**4**; dust fuel, Perret, Oct. 23-**5**.

FURNACE, and gas producer, Smith-Carson, *Eng.* Apr. 16; revolving cement, Ransome, Aug. 13; combust. gas, Oct. 29--6; coal smoke abatement, *The Eng.* Apr. 27; Siemen's regen. Nov. 30, Dec. 14-3; gas, Smith-Carson's, May 9; regen. gas, heating, new meth. of, F. Siemens, Oct. 3-4; Siemen's, Nov. 26-6.

GAREY, LEANDER, *Ry. & Eng.* Jan.-7; por. *Ry. Gaz.* Dec. 3-6.
GARRETT, JOHN W. *Ry. Gaz.* Oct. 3-4.
" RICHARD, *The Eng.* Aug. 8-4.

GAS, cheaper, Forstall, *Eng. News*, Nov. 10; inventor of [Wm. Murdock], Dec. 1-3; natural, in Ill. Dec. 12-5; do. piping for, May 1; do. and pipe, Dec, 4-6; do. Paine, Jan. 29, Feb. 26; do. long dist. transport., Christian, July 30; distrib., Westinghouse, July 30; nat., Pitts., Sorge, Sep. 10, 17-7.

" WATER, as fuel, *Iron Age*, June 28-3; introduction in London, Sep. 18-4; production, cost and profit, N. Y. Mar. 19; water, Mar. 26; nat., in iron and steel mills, Pitts. Apr. 2; do. heating power of, May 28; do. rep. July 16; water, Aug. 6; nat., hist. Aug. 27; manuf. Nov. 12-5.

" ILLUM., calorific power of, *Iron Age*, Feb. 4; producers, Feb. 11; nat., supply, Mar. 25; water, manuf. plant at Essen, Ger. Aug. 19; nat., use of in iron and steel wks. Oct. 7; manuf., stat. Nov. 4-6; lighting, candle power and illum., Pritchard, Mar. 24; water, in Austrian steel plant, Apr. 21; nat., composition, Sep. 1; furnace, regenerative, Swindell Construct. Co. Dec. 1; producer, Smith, Dec. 8-7.

" WATER, as fuel, Goodyear, *Mech.* June 23-3; mains, N. Y. May 10; nat., Hunt, May 31; illum., manuf. from sawdust, Walker, June 7; unit of light, Kruss, June 28; coal, some properties of, Aug.-4; wks., Ohio, Purdy, Apr; water, at Essen, Ger., Schultz, Aug.-5; lighting by incand., Dredge, sup. July-7.

" NAT., commiss. rep. *San. Eng.* May 23, 30, June 20, 27; July 11-25; do. Metcalf, Nov. 28, Dec. 5; do. Fulton, Dec. 26; and water supply, various cities, table, *Am. Eng.* Apr. 4-4; prices in different cities, Mar. 27; nat., conveyance, Apr. 3; water, openhearth furnace, Lilianberg, May 22; nat., pipe couplings, Young's, Dec. 3-5.

" HOLDER, large, *Am. Eng.* Jan. 7; consumption, Jan. 14; producers, Rowan, Feb. 4-6.

GAS, water, Lowe, *Am. Eng.* Mar. 4, 25, Apr. 1; nat., long dist. transportation of, Feb. 18, 25, Mar. 4, 18; do. do. Roberts, May 27, June 10-24; do. flow of gases formulae, Painter, Oct. 20; water, econ. of, Taylor, Dec. 15-6; making from coal tar, Burns, May 25, June 1-7.

" LIGHTING Met. opera h., N. Y. *San. Eng.* Dec. 27-3; vs. elec. lighting, rep. Ger., Renk, June 18; burners, heated air supply for, F. Siemens, July 16; lighting and ventil. of apartments, Sugg, July 23-5; legislation for N. Y. city, 4 bills, May 13; pressures in N.Y. city, July 22; coal, estimation of sulphur and impurities in, Fanley, Aug. 19; water, econ., as a fuel, Kent, Dec. 25-6; nat. supply of Pittsburg and vicinity, map, Jan. 15; commissions of Mass., rep. Feb. 26-7.

" WATER, *Van Nost.* Jan; burners, Sugg, Dec; wks., regen. furnaces, Munich, Schilling, Dec.-3; illum. and econ., Cheesman, Apr.-4; eng., el. principles of, Lane, Nov.-5; wells and streams measurement, Robinson, Aug.-6; water, as an econ. fuel, Kent, *Ry. & Eng.* Jan; nat., Paine, Jan..7.

" METER and burner, governing, *Fran. Inst.* Oct.-3; burners, Siemen's regen. Oct.-4; nat., util. Jan.-5; machs. and carburetters, Dec.-6; water, Lowe, rep. Novelties exhib. Jan, Feb; lights, Novl. exhib. Mar; nat., chem. compos. rep., Phillips, Oct, Nov.-7; reg., low-press., Pintsch, *Ry. Gaz.* May 21-6; nat., or rock, May 20-7; lighting, elec. *Elec. Rev.* July 25-5; do. devices, *Elec. World*, Feb. 16-4; cost of, in Am., table, Jan. 16-6.

" WATER, as fuel, Marx, *Sci. Am. Sup.* Apr. 7; do. July 14; do. manuf., N. Y. Aug. 18; main jointing and testing, Folkard, July 21, Sep. 1; retorts, heat regen. sys. of firing, Siemens' prin. Sep. 8; burner, Clamond's, Oct. 27; coal, residual product from, Greville, Mar. 15; do. in mechan. trades, T. Fletcher, Mar. 29; manuf. from limed coal, Wanklyn, Apr. 5; supplied to N. Y., manuf. and compos. May 24; illum., from sawdust util., G. Walker, June 7; do. Sep. 6; washer, Bandsept, July 19; lighters, induction spark, July 19; do. elec. Sep. 13; coal, carb. acid and illum. hydrocarbons in, tests, Dec. 20-4.

" NAT., Hequembourg, *Sci. Am. Sup.* Jan. 10; do. Fulton, Mar. 14; use of, in workshop, T. Fletcher, Mar. 21; meter, Clegg's, Mar. 21-5.

GAS, lamp, Wenham's, *Sci. Am. Sup.* Mar. 28; illum. ap., Foucault's, Apr. 4; water, incand. light, Fahnetijelm's, June 13; employment for cooking, Macadam, July 25; ap., Donson's, Aug. 8; burners, light and heat distrib. and air supply, F. Siemens, Aug. 15; exhauster, Meizel's reciprocating, Sep. 26; water, produc. ap., Goodyear's, Nov. 7; lighting and ventil. by, Sugg, Nov. 7; retorts, Coze's sys. Nov. 28; nat. fuel and applic. to manuf. purposes, Carnegie, Dec. 19; do. Dec. 26-5.

" NAT., at. Pitts. *Sci.Am.Sup.* Jan. 2; July 10; water, Thwaite, Mar. 6; coal, enrichment by hydrocarbons, Davis, Apr. 3; well at Findlay, O. May 15; wks., Birmingham, gas holder, May 29; nat., geology of, Ashburner, May 29; manuf. imps. June 26; eng., Lane, July 3; furnace, regen., W. Middlesex rolling mills, Jnly 31; carburetted air ap. Sep. 4; burners, Somzee's, Oct. 2; manuf., Stedman Stanley furnace, Oct. 16-6.

" NAT., Chance, *Sci. Am. Sup.* Jan. 8; do. Ashburner, Feb. 12; furnace, Henderson, Jan. 15; Co's of U. S. Feb. 5; burner, incand., Welsbach, Mar. 12; holder at Erdberg, Mar. 26; manuf. from paraffine oil, Macadam, July 2; eng., regen. sys., Macpherson, July 9; leakage detection, Rattier, Aug, 13; light, incand., Welsbach, Aug. 13; coal, proc. for es. carb. acid in, Sheard, Sep. 10; distil., temp. of, Sep. 17; balance, for composition and spec. grav., Lux, Sep. 24; nat., long dist. transmiss., Christian, Oct. 29; generator, duplex, Nov. 12; ap., Eliott's, Nov. 12; nat., conversion into illum. g. Nov. 26-7; coal and water (illum.), relative poisonous properties of, Sedgwick, *Soc. Arts*, Oct. 8-5; nat., and oil, meths. of drilling for, Newell, Jan. 7-6.

" MAKING plant, Donson's *Eng.* Feb. 9; exhauster and hor. eng., Reale's, Apr. 6; do. Gwynne's, May 11; holder at Rheims, Debranne, May 11; Co's, Met., England, June 8-3; water, Apr. 3; wks., scrubber, St. Albans, Box, Apr. 17; nat., Carnegie, July 10, 17 &c; Inv's exhib. July 31, Aug. 7, 28; water, Oct. 30-5; producers, Thwaite, Jan. 22; water, Jan. 15; nat., burning, at Pitts. Mar. 26, 26; heating power, Apr. 30; water, May 7-6; burner, incand., Welsbach, Feb. 4; Inst. pro. July 1, 8; making mach., aut. Dec. 23-7.

" BURNING SYSTEMS, *The Eng.* Jan. 12; wks. roofs, Wallasey, Feb. 16; wks. purifier house, Bury, Apr. 20-3.

GAS, water, *The Eng.* May 25; do. Nottingham, June 15; do. Sheffield, pump house, June 22; lighting, inv. of, Wm. Murdock, Aug. 3-3; illum. power, instrums. for testing, Sep. 19; wks., Coventry, gas holder, Nov. 14, 14-4.

" WASHER, scrubber, Waller's, *The Eng.* May 15; nat., fuel, Carnegie, May 22; exhauster, Greenaway's, June 26-5; producers, Rowan, Jan. 22; wks., Birmingham, gas holder tank, largest, Apr. 9; do. Hunt, eng. May 21; do. largest, n. May 21; do. May 28, June 4; supply, London, June 18; wks., retort charging, Vross sys. Aug. 13, do. Beckton, Aug. 20-6; producers, Thwaite, Jan. 28; coal, and air mixture explosions, Douglass, Apr. 22; supply, London, July 1; nat., fuel, value of, table, Phillips, Sep. 30; meter, Ochwadt self-registering, Dec. 30-7.

" ENGINES, pumping, Crown, *Eng. News*, Sep. 13-4; Otto plant, at Prague, Aus. Dec. 25-6; Sombart, *Iron Age*, Mar. 1; Parker, Nov. 1-3; Seraine's, June 5; effic. July 31-4; econ., recent imps. in, Jan- 7, 14; theory of, Mar. 11; Atkinson, Sep. 16-6; Otto, Prague, Aus., elec. light plant, Jan. 27; do. Coblenz, water wks., Ger. May 19; do. vertical, Sep. 1-7.

" ENGS., Universal, *Mech.* Jan. 20; Sombart, Feb. 17; Parker, Oct. 27; and producing plant, Davison, Dec. 29-3; Forest, Jan. 5; Otto, expts., n. Jan. 12; vertical, Seraine, May 10; Delamare, Rouen, France, Nov.-4; working, Feb; effic. Mar. Korting, June; differential, Atkinson, Oct.-5; and pump, Otto, *Am. Eng.* Nov. 26-5; vertical, Otto, Sep. 28-7; starting valve, Atkinson's, *San. Eng.* Feb. 26-7; Otto, expts., Brooks, *Van Nost.* Feb.-4; theory, Feb.-6; Clerk, Otto, rep. *Fran. Inst.* Oct.-5; Stockport, Clerk, rep. Sep.-6.

" ENGS., and generator, Parker, Yonkers Fuel Gas Co. *Electric.* Aug.-3; do. *Elec. Rev.* Jan. 3-4; Korting, Nov. 13-6; and stm. motors, effic., Holgate, *Sci. Am. Sup.* Jan. 20; Wordsworth's, Apr. 14; Edward's, Sep. 29; and producer, Donson's, Nov. 17; explosions, Nov. 17-3; motor, Forrest's, Mar. 1; Seraine's, June 21; Stockport, Nov. 1; Universal, Barker, Nov. 8; working of, Dec. 27-4; D. Clerk, Apr. 11; Anderson, Aug. 22; prins. of, D. Lane, Sep. 26; econ. Oct. 3-5; Benier's, Apr. 10; Lenoir's carburetted air motor, June 12-6.

GAS ENGS., Otto wks. *Eng.* Feb. 15; and caloric, Mar. 24-**4**; Korting, Inv's exhib. May 8; differential, Atkinson, do. Aug. 21-**5**; Delamare, Mar. 26; Otto, July 16; Atkinson, Aug. 27-**6**; do. trial, Unwin, May 6; Otto, Crossley, July 8-**7**.

" ENGS., Worsam's, *The Eng.* June 29; Edward's, Aug. 10; Donson's, Oct. 5; do. gas as motive power, Nov. 2-**3**; and caloric, F. Jenkin, Mar. 7; Seraine's May 9; Otto's, May 30-**4**; Stockport, Mar. 6; at Inv's exhib. July 24; Atkinson's differential, Aug. 7; Clerk's, Oct. 2; Volk's gov. attach. Oct. 16; Syrinx, Nov. 6; theory of, Rochas, Dec. 4; Atkinson's, Dec. 18-**5**; Wright's & Barnett's, Jan. 1; Korting, Mar. 26; Mar. 26, n. Apr. 9; Trent, May 21; Atkinson's, Aug. 27; Brydges, Oct. 1-**6**; do. May 6, 13; Otto, May 27; Rollason's, Sep. 30; aut. Dec. 23; Atkinson's cycle, Dec. 30-**7**.

GASEOUS MIXTURES, explosion of, *Eng.* Mar. 12-**3**. See also EXPLOSIVES.

GASES, expansion of, *Am. Eng.* June 17-**6**; kinetic theory, Eddy, *Van Nost.* Feb, Mar.-**3**; liquefiable, critical point of, *Fran. Inst.* May-**4**; ap. for measuring compressibility at high pressures, Amagat. *Sci. Am Sup.* Oct. 9-**6**.

GATES, folding, and shutters, Bostwick's, *The Eng.* Sep. 23-**7**.

GAUGES, standard sys., Bond, *Van Nost.* June-**3**; do. lengths, do. *Eng.* Dec. 11, 25-**5**.

GEORGIA, Capitol bids, *Eng. News*, Oct. 11-**4**.

GEARING, gear wheel, large, *Iron Age*, Jan. 31-**4**; do. cutting mach., Piat, Paris, *Mech.* Mar. 24; cog teeth shapes, Stanwood, May 12; gear cutter, Newton, June 9; do. mach., Albro, Sep. 15; strength of spur and bevel, W. Lewis, Sep. 22; wear of teeth, Dec. 1-**3**; sys. of, Jenkin, Jan. 5; cal. of, Pemberton, July-**4**; backlash in, Aug.-**5**; gear cutting, large, Mar; do. wheels, H. P. n. May-**6**; friction in toothed, Lanza, Dec.-**7**.

" WALKER'S SYS. *Am. Eng.* May 9-**4**; gears, small, Mar. 25; crypto-dynamic, Apr. 8-**6**; odontograph, Grant's, Mar. 2; wheel teeth, Last, July 27, Aug. 3-**7**; for metal planers, *Fran Inst.* June-**3**; power transmiss. by, June, Aug; gears, bevel, cutter, Belgium, rep. Aug.-**6**; odontograph, Grant, Feb; teeth of, effic., Grant, May-**7**.

GEARING, TEETH, limiting numbers of, MacCord, *Sci. Am. Sup.* Feb. 3-**3**; do. Grant, May 7-**7**; gear wheels, Suplee, *Power & Trans.* Sep.-Nov.-**7**; nest, *Eng.* Oct. 26-**3**; gear cutter, bevel, Bilgram, July 3-**5**; do. *Am. Machinist;* power transmiss. by, *Eng.* Apr. 9; teeth for, Oct. 8-**6**; gear bevel, cutting mach., Brehmer's, *The Eng.* July 10-**5**.

GEOGRAPHY, Greely arctic exped. results, *Sci. Am. Sup.* Sep 6; Iceland, Sep. 6-**4**; prog. of, Oct. 8-**7**.

GEOLOGY, geolog. survey of Italy, *Van Nost.* Feb.-**3**; Petrography, Teale, June-**5**; anthracite measures stratification, Penn., Wasmuth, *Fran. Inst.* Aug.-**7**; exploration and surveys in west, Gratacap, *Sci. Am. Sup.* May 24-**4**.

GERMANY, civil cases procedure, *Eng. News*, Apr. 23-**7**; industries, *Iron Age*, Aug. 30-**3**.

GILBERT, WM., por. *Sci. Am. Sup.* Sep. 13-**4**.

GLACIER, motion, causes of, *Sci. Am. Sup.* Aug. 18-**3**; Muir, Wright, Feb. 5-**7**; motion, W. B. Browne, *The Eng.* Feb. 9-**3**.

GLASS, manuf. *Eng. News*, Dec. 8-**3**; hardened and tempered, *Iron Age*, Apr. 16; window, trade, Aug. 27-**5**; blowing mach., Wright, *Mech.* Jan. 6; making in Bohemia, Feb. 10-**3**; hardened and tempered, F. Siemens, Apr.-**5**; tempered, do. *Am. Eng.* Apr. 24-**5**; do. *Van Nost.* Aug.-**5**; manuf. *Fran. Inst.* Aug.-**4**; making, Henderson, Sep.-**7**.

" BLOWING, by compressed air, *Sci. Am. Sup.* Aug. 25; wks., Val St. Lambert, Sep. 29; Murano, Jarves, Nov. 24-**3**; blowing ap. Aug. 30-**4**; soluble, Apr. 4; tempered, F. Siemens, June 27-**5**; window, manuf. with nat. gas, July 10-**6**; Lupton, May 7; drawing mach., Oppermann, June 11; decorative, Pollen, Sep. 3-**7**; *Locom.* Oct.-**5**; and glass making, Gaffield, *Soc. Arts*, Nov. 22-**3**; *Eng.* Nov. 9-**3**; blowing ap., Health exhib. July 21-**4**; tempered, Mar. 6-**5**; sheet casting table, Daglish, Jan. 21-**7**; wks. of Val St. Lambert, *The Eng.* Aug. 10-**3**; hardened, F. Siemens, Mar. 13-**5**.

GOULD, JAY, *Eng. News*, Sep. 8, Oct. 6-**3**; opinions of, *Ry. Gaz.* Sep. 7-**3**.

GOLD and silver production, U. S. '84, *Locom.* Jan.-**5**. See also METALS, GOLD and SILVER.

GRAIN, stored, pressure of, Roberts, *Eng. News*, Apr. 7-**3**; wheat crop of world, *Iron Age*, Sep. 22-**7**; shoveling mach., Lotz, *Am. Eng.* Oct. 1-**5**; elevators, *Eng. & Bu. Rec.* Nov. 12-**7**; exports U. S. *Ry. Gaz.* Jan. 23; elevator, 60th St. Station, N. Y. Cen. R., N.Y. Jan. 30, Feb. 6; wheat production., U. S. Feb. 13; crops, '85, Oct. 16-**5**; exports, Newport News, Apr. 9; crops, July 16; do. U. S., '86, Oct. 29-**6**.

" RECEIPTS, N. Y., Boston, Phil. and Balt., '86, *Ry. Gaz.* Jan. 21, 28; exports, Jan. 21; receipts, No. West. Mar. 18, Apr. 29; crops of world, '86, Apr. 8; receipts, Apr. 22; do. Atlantic ports, Sep. 30; wheat supply of world, '87-8; Oct. 7-**7**; warehousing mach. *Sci. Am. Sup.* Mar. 31; separating machs., Marot's, Apr. 28; elevator, Watson plan, June 16; do. Poulsom's Nov. 17-**3**; scouring ap. Nov. 22-**4**.

" WAREHOUSING, mach., Albert dock, Hull, *Eng.* Feb. 2; elevator, Poulsom's, Oct. 5; do. Dow's stores, Brooklyn, Sep. 14, Oct. 19, Nov. 2-**3**; do. floating, 50 ton, Spencer, Feb. 27-**5**; do. portable, and crane, Lyster, Apr. 9; do. vessel, Thwaite, Oct. 22-**6**; conveyor, Anti-friction Co. July 29-**7**.

GREAT BRITIAN, landed proprietors of, *Locom.* June-**3**. See also BRITISH; ENGLAND.

GREELEY, LIEUT., recovery, *Sci. Am. Sup.* Oct. 11-**4**.

GREENLAND, *Eng. News*, Aug. 11-**3**; exped., Nordenskjold's, *Sci. Am. Sup.* Feb. 2-**4**; *Eng.* July 27-**3**.

GRINDSTONE, *Fran. Inst.* Aug.-**3**.

GROVE, WM. R., por. *Sci.Am. Sup.* May 30-**5**.

GUNNERY AND ARMOR, modern ordnance, *Eng. News*, May 12; gun, Haskell multi-charge, Nov. 3-**3**; armor, cast iron, expts., Gruson, May 3; ar. plate trials, do. rep. May 24; ar. behavior, C. O. Browne, May 31; gun, Gatling, Aug 16; do. 6-lb. rapid firing, Brit. navy, Sep. 13; ar., chilled cast iron, expts., French and German, Schutz, Nov. 15; gun, Maxim mach. Dec. 6-**4**.

" GUNS, Berdan shell, *Eng. News*, Feb. 21; projectile vels. Apr. 4; England's naval armament, May 2; ar. plate trials, Gruson, May 9; gun, Maxim mach. June 27; guns, large, Aug. 22; gun material, U. S. ordnance rep., Bixby, Oct. 17-31, Nov. 7-28, Dec. 5-26-**5**; ar. tests in Europe, Jan. 9, 23; ar. material do. rep., Bixby, Jan. 16; ar., chilled cast iron, May 27-**6**; guns, use of steel in, Mar. 26-**7**.

GUNNERY AND ARMOR, gun, dynamite, Zalinski's, trials, *Iron Age*, Apr. 24; do. Smith, June 19; do. Maxim's mach. Dec. 18-**4**; ar. plates, chilled cast iron, French and German expts. Jan. 8; guns as heat engines, Apr. 23; ar. plates manuf. May 7, 21; gun, Maxim mach. June 25-**5**.

" ARTILLERY, modern, *Iron Age*, Aug. 12; guns, pneu., in war, Aug. 19; gun trials, Nordenfelt, Sep. 16; U. S. ordnance, Nov. 18-**6**; gun carriages, crusher gauges for, May 12; guns, magazine and repeating rifles, Mar. 24; do. steel, Rodman prin. applied to, Mar. 24; do. and ar., Am., Mar. 31; do. and turrets, disappearing, July 21; do. modern, Carbutt, Aug. 4-**7**.

" GUN cartridges, *Mech.* Mar. 22; guns, large, for U. S. govt. Apr. 26; ar., cast iron, expts. May 10-**4**; gun explosions, Jan. Mar; guns as heat engs., Anderson, Apr.-**5**; gun making in Am., Waters, Jan; g. and ar., U. S. coast defense, Morgan, sup. June-**7**.

" GUNS, heavy ordnance, Michaelis, *Am. Eng.* June 27; do. do. Meatyard, July 18; do. and ar. behavior, C. O. Browne, July 18, 25-**4**; and ar., chilled cast, French and Ger. expts., Schutz, Jan. 16; guns as heat engs., W. Anderson, May 1; gun, Maxim mach. July 23-**5**; guns, great, Meatyard, Sep. 29-**6**; gun, dynamite, Apr. 13; guns, casting heavy cannon, Allen's meth. Aug. 24-**7**.

" ARMOR plate expts. *Van Nost.* Jan; gunnery expts. at Spezzia, Mar; ar., hard, July; ar., steel vs. comp. Dec.-**3**; guns, armament question, n. Apr; ar. under fire, Browne, July-**4**; gun, air, dynamite, Zalinski, Jan; dynamite shells, June; ar. plates, Aug; projectiles resistance, n. Oct; gunnery expts., n. Nov.-**5**; guns, cause of erosion in bore of, Lanfray, Apr; gun, Nordenfelt, n. Sep.-**6**; guns, 110-ton English, *Ry. & Eng.* Apr; do. mag. and repeating rifles in Europe, James, May; gun carriage, hydro-pneu., disappearing, Armstrong, English, Aug.-**7**; projectiles vel., elec. det. of, *Fran. Inst.* Aug.-**5**; do. do. Houston, *Elec. World*, Aug. 8, 15-**5**; gunnery, applic. of elec. to devel. of markmanship, Michaelis, Aug. 7, 14-**6**; gun, dynamite, Zalinski, expts. *Electric.* Oct.-**7**; do. elec., Monfort, *Elec. Rev.* June 20-**5**.

" GUN, 100-ton, breech loading, Italian trials at Spezia, *Sci. Am. Sup.* Mar. 3; do. Lyman-Haskell, Aug. 11; do. 20-ton Whitworth, trials, Oct. 6-**3**.

GUNNERY AND ARMOR, guns and ar. plated forts, expts. on, at Shoeburyness, *Sci. Am. Sup.* Oct. 13; gun mechanism, Oct. 27; war rockets explosion, Woolwich arsenal, Nov. 10; gun, Haskell's multicharge, Dec. 22-3; ar. plate, chilled iron, Gruson's, testing, Apr. 12; gun, Gardner mach. Apr. 19; do. wire, construct., Longridge, May 10; do. Gatling, June 7; guns, heavy, of '84, Maitland, Aug. 16; gun Maxim mach. Nov. 8; gunnery, linked shells, Cochrane, Nov. 15-4.

" GUNNERY, shell and fuse, Berdan's, *Sci. Am. Sup.* Feb. 7; ar. plate trials at Spezia, Mar. 28; guns, as heat engines, W. Anderson, May 30; do. Krupp breech loading, June 6; gun press. gauge, Shaw's, June 6; guns, Hotchkiss', mach. June 13; do. and ar. penetration, June 13; do. mach., Inv's exhib. June 20; do. Nordenfelt, do. July 25; do. range of, Aug. 8; do. conversion of heat into wk., W. Anderson, Aug. 15; gun, 13-in. De Bange's, Aug. 29; g. and ar., mild steel for, Mackinlay, Sep. 5; guns, great, comparison, table, Oct. 10-5.

" FORTIFICATIONS, iron in, *Sci. Am. Sup.* Mar. 6; shot gun, Spencer, Mar. 27; ar. plate turrets, expts. at Bucharest, May 22; Gruson's turret trials at Spezia, Aug. 28; gun, army, U. S. Oct. 2-6; do. 110 1-2-ton Elswick, for str. Benbow, Mar. 26; do. mag., German, Apr. 2; guns, steel, Sumner, Apr. 16; do. mag. and repeating rifles, James, Apr. 30; do. Maxim, May 7; do. dynamite, May 14; do. steel, Maitland, May 14; do. mag. rifles, June 11; gun, Krupp, 52-ft. June 18-7.

" GUNS, Elswick, Armstrong, 110 1-2-ton, Newcastle exhib. *Sci. Am. Sup.* July 2; gun, mag. rifles, Lee mag. gun &c. July 9; do. Maxim, July 16; do. 110-ton Armstrong, Oct. 15; do. great, Krupp, Oct. 29-7; do. heavy, construct., C. Shaler, *Soc. Arts*, Feb. 12; guns, heavy, casting at So. Boston, Lyle, Feb. 12; gun, pneu. dynamite and use of high explosives in warfare, Zalinski, Dec. 23-5.

" GUNS, mach., Nordenfelt, *Eng.* Jan. 19, Feb. 9, 16; do. modern ordnance, Jan. 19; gun, mach., Nordenfelt, Jan. 26; artillery, field, Italian, Apr. 6; guns, Krupp and Armstrong, Dec. 14-3; gunnery, Brit. naval, Jan. 4, 11, 25, Feb. 15, 29, Mar. 14, 28, Apr. 11, June 6, 20, July 11, Aug. 1; gun, mach., Gardner, Feb. 15; do. breech loading, Phillip's, Feb. 22; guns, mach. Feb. 29; gun practice at sea, Mar. 14-4.

GUNNERY AND ARMOR, armor, cast iron, expts., Gruson, *Eng.* Apr. 4; guns, mach. Apr. 4; gun, Gatling, Apr. 25; guns, double barrel and rifles, May 2; do. English ordnance, May 30, June 27; do. wire, treatise on, July 25; do. Nordenfelt mach. Aug. 1; gun, 6 pounder, Brit. navy, Hotchkiss, Aug. 8; guns, construct. of ordnance, Sep. 19; gun, 110-ton Armstrong, Oct. 24; do. wire, construct. Nov. 7; do. mach., Maxim, Nov. 7; do. factories, France, Nov. 21; do. shell, Berdan and mechan. fuse Dec. 26-4.

" GUNS, strength of, *Eng.* Apr. 10; gunnery, England's naval armament, Apr. 17; gun, artillery at Inv's exhib., Gardner, Anderson, Hotchkiss, May 1; do. do. Nordenfelt, May 15; do. mach., Maxim, June 5; do. mach., Gardner, Aug. 14-5; do. wire, construct. Jan. 22; do. dynamite, Zalinski, Feb. 12; do. "Collingwood," June 11; do. barrels, erosion of, Oct. 22; guns, rifled, English, Dec. 10-6.

" GUNS, Armstrong, table, *Eng.* Jan. 28; do. Krupp, Feb. 4; do. heavy, steel for, Jaques, Feb. 18; gun, 110-ton Elswick, Feb. 18; guns, mag. and repeating rifles, Mar. 4; do. Maxim, Mar. 18; gun, dynamite, pneu. torpedo, Apr. 15; guns and ar., steel for, Apr. 22; guns, mag. rifles, Spencer, Winchester, Vetterli, Hotchkiss, etc. Apr. 29, May 6; gunnery, artillery fire, accuracy, May 6; do. steel projectiles, May 6; gun, 110-ton, Longridge, May 13; do. mach., Maxim, on steel carriage, June 3-7.

" GUNS, Elswick, wks. *Eng.* July 29; do. ordnance exhib., Newcastle, July 29; gun carriages, modern, Aug. 19, 26; gun, 110-ton Elswick, Armstrong, Sep. 9; guns, Zalinski dynamite, expts. Oct. 21; do. steel projectiles, Oct. 28; do. mag. rifles, Nov. 11; do. wire, Longridge, Nov. 11, 18; do. as thermodynamic machs., Dixon, Dec. 23-7.

" GUN, 110-ton Armstrong breech loading, *The Eng.* Jan. 26; effects of shot on steel-faced plates at St. Petersburg, Apr. 6; guns, Belgian, July 27; steel shot trials, Palliser's, Aug. 3; ar. plate fort at Shoeburyness, Aug. 31, Sep. 28; rocket explosion, Woolwich arsenal, Sep. 28-3.

" GRUSON chilled iron shield trial at Buckan, *The Eng.* Feb. 22; ar. plate trials at Copenhagen, Mar. 28, May 30; gun, wire, construct., Longridge, Mar. 28; guns, heavy, of '84, English and foreign, Maitland, June 27; do. dynamite, Am. Sep. 19-4.

GUNNERY AND ARMOR, guns, dynamite, *Sci. Am, Harper's Weekly*, *Army & Navy Jour;* linked shells, *The Eng.* Oct. 10; gun. Maxim mach. Oct. 10; guns, effect of obstructions in gun barrels, Nov. 7-4.

" GUN, Nordenfelt 6 lb. quick firing, *The Eng.* Feb 6; do. bursting, str. Active, Feb. 6; guns, as heat engs., W. Anderson, Feb. 6; do. strength of, Feb. 13; ar. plate trials at Spezia, Feb. 27; gun press. gauge, hydr., Shaw's, Apr. 24; guns and war stores, May 8; Gruson's chilled iron ar. expts. May 8; protective power of ar. plates, May 15-5.

" GUNS, combust. of gunpowder in, J. F. Meigs, *The Eng.* July 3; see also EXPLOSIVES; wrt. iron ar. plates, laws of penetration, July 24; guns, De Bange's, Antwerp exhib. Aug. 14; do. Montcrieff carriages for Russian ironclads, Sep. 25; ar., Cadiz target and Armstrong guns, Sep. 25; guns, English, French view of, Oct. 16-5.

" GUN, submarine, Ericsson's, *Tne Eng.* Jan. 22; do. dynamite, pneu. Jan. 22; Gruson's ar. at Spezia, Apr. 30; do. do. turret ar. trials, May 7, 14; gun, Martini-Enfield rifle, July 2; Gruson shield at Spezia, Aug. 6; gun, Enfield small-arms factory (Martini rifle), Aug. 20; guns, rifles, foreign, Aug. 20; do. U. S. ordnance, Ang. 20; gun, Collingwood, rep. Sep. 24; steel faced ar. plates, Nov. 26, Dec. 17, 17-6.

" GUN, 110 1-2 ton Elswick, for str. Benbow, *The Eng.* Feb. 11; guns, mag. and repeating, W. H. James, Mar. 11; do. mag. German rifle, Apr. 1; gun steel, treatment, Maitland, Apr. 1; guns, Canet protected, Apr. 8; do. Elswick, Newcastle exhib. May 13; gun, 67-ton breech-loading, Aug. 12; effect of St. Chamond projectile on steel-faced plate, Sep. 2-7.

HAIR-BRUSHING MACH. Willonghby's, *The Eng.* May 11-3.

HALLIDIE, ANDREW S. *St. Ry. Gaz.* June-7.

HAMMERS, drop, lifting device for, Ward, *Iron Age*, May 5-7; do. Hasse, Belgium, *Mech.* June 18-4; Beaudry, *Am. Eng.* Mar. 27-5; gas, Robson's, *Sci. Am. Sup.* Nov. 6-6; do. *The Eng.* Sep. 10; power, pneu., Player's, Dec. 17-6; do. *Eng.* June 20-4; do. Thwaite's, Jan. 22-3; duplex, Equit. *The Eng.* Apr. 24-5; power, Wild's, May 27-7. See also STEAM HAMMERS.

HANK DYEING and wringing mach., Robertshaw's, *Sci. Am. Sup.* Nov. 28-5.

HANSCOM, WM. W., por. *St. Ry. Gaz.* June-**6**.

HARBOR ENGINEERING. See also DREDGING; RIVERS.

" ENG., wharf moorings, *Eng. News*, June 23-**3**; Antwerp wks. Sep. 22; jetty sys., Eads, June 28; concrete construct. Aug. 9; imp. and connection of Hudson and Harlem rivers, Newton, Aug. 30; jetty, Galveston, Nov. 29, Dec. 27-**4**.

" ENG., dry-dock, Simpson, St. Johns, Newfoundland, *Eng. News*, Feb. 21; sea-wall, Brighton, England, Apr. 11; rock removal by diving bell, Apr. 25; jetties, Apr. 25; floating landings, Schrader, Aug. 8; rock removing under water, Welland canal, James, July 11; concrete breakwater, Newhaven, England, July 25; imp., N. Y., Hell Gate, (Flood rock), Sep. 12-**5**; of refuge, Nantucket, Mass., proposed, Jan. 8; imp., Nantucket, L. M. Haupt, Apr. 16; Simpson dry timber dock, Stockton, England, May 28-**7**.

" ENG., dry dock construct. in quicksand, Hamburg, *Iron Age*, June 11; Hell gate imps. July 23-**5**; quay walls, Sep. 9-**6**; Cardiff lifting dock, *Mech.* Oct.-**4**; floating breakwater, July; N. Y., flood rock explosion, Nov.-**5**; subaqueous foundations, Gaertner, *Am. Eng.* Apr. 29-**6**.

" ENG., N. Y., Hell gate imp., maps, *San. Eng.* Dec. 3-**5**; dry docks, Havre, France, *Eng. & Bu. Rec.* Dec. 3-**7**; concrete in sea-water, *Ry. Gaz.* Sep. 2; docks, Ashland, Wis., Wis. Cen. R. Oct. 7-**7**; dock, Alexandra, Hull, England, *Van Nost*, May; defense by submarine mines, Sleeman, Oct.-**3**, and docks, Gould, May-**5**; tides and coast wks., Stevenson, Feb. -**6**; floating locom. *Ry. & Eng.* Mar; N. Y., imp. June-**7**; imp. of port of Phil., Haupt, *Fran. Inst.* Nov.-**7**.

" ENG. floating dock, St. Nazaire, France, *Sci. Am. Sup.* Mar. 17; Lyttelton port and graving dock, New Zeal. June 2; concrete in marine construct. June 2; floating breakwater, Oct. 6-**3**; coral reefs, origin of, Mar. 8; dry docks at Erie basin, So. Brooklyn, July 5; Antwerp, imps. July 26; dry lifting dock, Cardiff, Aug. 23; concrete for marine construct. Sep. 13; gas-light buoy, Sep. 20; Havre roadstead, Sep. 20-**4**.

" ENG., dock wall construct. with iron pile planks in found. under water, *Sci. Am. Sup.* Jan. 3; buoy, Courtenay's whistling, Jan. 3; do. Brown's bell, Jan. 3; Reunion Is. Ry. and port, Mar. 14; dry timber docks, May 2; Tilbury deep water docks, May 23; floating, at Havre, wharf walls construct. May 23-**5**.

HARBOR ENG., St. Petersburg seaport maritime canal, *Sci. Am. Sup.* July 11; sandbag embankments, Osborne, Sep.12-5.

" ENG., N. Y., Flood rock removal, *Sci. Am. Sup.* Jan. 2; slipway, hydr., at Hiogo, Mar. 27; Tilbury deep water docks, May 29; India, west coast, July 17; wks., Buenos Ayres, Dec. 11-6; wk., concrete in, papers, Inst. C. E. Jan. 1; floating hos., Laws, des. Feb. 26; Port of Cadiz, July 23; floating dry dock, Cardiff, Oct. 15; land slip at Zug, Switz. Nov. 12-7; Boston, Raymond, *Soc. Arts*, Jan. 5; submarine mines, function of, in seacoast defense, H. L. Abbot, Mar. 26-5.

" ENG., braced piers and supports, *Eng.* June 1; and coast buoyage Oct. 12; harbors of refuge, Feb. 9, Mar. 9, Aug. 17, Oct. 26, Nov. 2, 9, Dec. 7-3; do. May 30; do. Peterhead, Aug. 22; at Trieste, Feb. 22; docks and coal shipping at Cardiff, England, July 18, Aug. 1-15; Alexandra dock, Newport, Aug. 15; landing stage and pontoon, hos. ship, "Castalia," Nov. 21-4.

" ENG., Otago Port, New Zeal. *Eng.* Jan. 23; dry timber dock, Simpson, Mar. 27; and coast defense, May 1; floating breakwater, May 15; concrete breakwater, Newhaven, England, July; N. Y., Flood rock explosion, Oct. 30-5; submarine do. Jan. 1; dock yard expenditure, England, July 2; Chatham dock yard, Oct. 22, Nov. 5; Clyde graving dock, Nov. 19; Dec. 3; hos. on Tyne r. Dec. 17-6.

" ENG., Esquimalt dock, Brit. Colombia, *Eng.* Feb. 18; wks., Lisbon, projected, Mar. 4; composite light-ship, "Puffin," Schlesinger, May 6; dock at Kowloon, Hong-Kong Co. July 22, Aug. 5; Malta dock yard centrif. pumps, Moreland, Aug. 26; Cardiff off shore floating, Clarke, Sep. 9; dry dock, San Fernando, Buenos Ayres, Nov. 18, 18; hydr. lifting dock, Bombay, Nov. 25-7.

" ENG., wrt. iron cyl. beacons, *The Eng.* Feb. 2; fog signal ap. for lightship and signal station, Feb. 16; fog signalling ap., Holmes' siren, Mar. 2; caisson, Lyttelton graving dock, New Zeal. Feb. 23; ferry landing stage, Jarrow, Tate, eng. Mar. 30; floating self propelling dock, Rennie's, Apr. 6; wks., Antwerp, Aug. 10; slipway hauling mach., Ayr. har. Dec. 7, 7, 14-3; slipway and ship cradle, do. Feb. 22, Mar. 28; Preston dock and ribble imps., Garlick, June 20; docks at Boston port, Witham r., Wheeler, eng. Dec. 26-4.

HARBOR ENG., Brighton beach wks., Coode, des. *The Eng.* Feb. 13; Tilbury deep water docks, Apr. 3; East Scottish, July 10; Antwerp quays, July 31; N. Y., Flood rock removal, Hell Gate, Oct. 9-**5**; Royal Albert dock extens., Carr, eng. Feb. 5–19; Greenock har., map, Mar. 12; quay walls construct. at Rotterdam, Ysselsteyn, Mar. 21; Alexandra dock pumping mach. Sep. 3; Buenos Ayres port and wks., Nov. 5; concrete construct., Inst. C. E. Dec. 17; Eyemouth har., Merk, eng. Dec. 17-**6**

" ENG., wharf, screw pile, at Kurrachee, *The Eng.* Jan. 21; do. exten. Apr. 15; Cardiff dock and Rys., Barry, Mar. 4; buoys, spherical and conical, Mar. 25; pier at Salto r., Uruguay, Wilson, Apr. 15; harbors of refuge, Apr. 22; wks., Algoa bay, Cape Colony, Shield, Apr. 29; promenade pier, Folkestone, Ridley, May 27; St. Helier har. July 1; Ceara wks., Brazil July 29; Calais har. imp. Aug. 26; Preston dock and Ribble run, Sep. 30, 30; tidal estuaries and bar of Mersey r., Wheeler, Nov. 11-**7**.

HARDWARE, store arrangements, *Iron Age*, July–Dec.-**5**; do. files-**6**; in Germany, Apr. 1-**6**; prices current, *Iron Age* files.

HARRISON, JOHN, *Sci. Am. Sup.* Apr. 7-**3**.

HATHAWAY, CHAS., por. *St. Ry. Gaz.* Aug-**6**.

HAT MAKING, wool, *Sci. Am. Sup.* Dec. 31-**7**.

HAWAII, U. S. trade with, *Iron Age*, July 14-**7**.

HAYTI, U. S. trade with, *Iron Age*, Aug. 27-**5**.

HEALTH, unhealthy occupations, *Iron Age*, Feb. 25-**6**; malaria, Sternberg, *San. Eng.* Jan. 11–25; germs and epidemics, Mar. 1–29; food and illum. oils, adulterations, C. F. Chandler, rep. Apr. 19-**3**; Internat. exhib. June &c.-**4**; Am. Pub. Assoc. pro. Oct. 14-**6**; and artif. lights, *Elec. Rev.* Jan. 3; and elec. light, July 26-**4**.

" ALCOHOL habit, Carpenter, *Sci. Am. Sup.* Jan. 13; pneumonia, Delafield, Mar. 24; malaria, Salisbury, Mar. 31, Apr. 7–28, May 5–19; alcohol in, Barlow, Apr. 21; poisoning by nitrate of silver, Mott, May 19; breathing, Wark, June 2, 9; hair, Shoemaker, June 9; cereal foods, Cuzner, June 30-**3**.

" COOKERY, sci. of, W. M. Williams, *Sci. Am. Sup.* Mar. 1, 8; and wk., national, Paget, Aug. 9; malaria, nature of, Dowling, Aug. 30-**4**.

HEALTH, temperance reform, scientific basis of, B. W. Richardson, *Sci. Am. Sup.* Sep. 13; temp., moisture and pressure in relation to, Tripe, Sep. 20; malaria, Tommasi, Oct. 11; cholera, Koch, Oct. 11-4; do. F. H. Hamilton, Jan. 10; do. microbe, Feb. 7; mental contagion in inebriety, Crothers, Jan. 31; alcohol props, T. L. Wright, Jan. 31; cultivation of microbes, Oct. 17-5.

" BACTERIA of disease, Hun, *Sci. Am. Sup.* June 12; tyrotoxicon, in poisonous ice-cream, Vaughan, Aug. 28; inorganic foods, Randolph, Sep. 18; why some people grow fat, Randolph, Oct. 16; social waste of a great city, Seaman, Nov. 6; disinfection by heat, Parsons, Nov. 27; veget. and fatty food diets, Beaumetz, Dec. 4-6; and longevity, Buchanan, Mar. 12; climate relations to, Poore, May 7-28, June 4; distrib. of micro organisms in atmos., Frankland, July 30; genesis of Bright's disease, Fothergill, Aug. 13-7.

" HYGIENE, *Locom.* Sep.-6; relations of micro organisms to disease, Marcy, *Soc. Arts*, Feb. 28; cholera, etiology and prog. of, Shattuck, Oct. 23-4; do. Asiatic, from a layman's point of view, Brewer, Feb. 26-5; chem. of foods and nutrition, Atwater, Apr. 22-6; disinfector, Thursfield's ærosteam, *The Eng.* July 29-7.

HEAT, flameless combust. *Iron Age*, Oct. 25-3; conducting power of materials expts. Oct. 9-4; specific and latent, Van der Weyde, *Mech.* June 16-3; reg., metastatic, Randolph, Nov-4; solar, as motive power, Tellier, n. Dec.-5; thermodynamics, Reynolds, *Van Nost.* Feb.-4; combust. *Ry. & Eng.* June-7.

" ABSTRACTION by mechan. energy, *Fran. Inst.* Feb; do. (cold) Apr; radiant, Mar.-3; reg., metastatic, Sep.-4; refrig. mach. as heater, Aug.-6; thermod., Wood, Feb.-Apr.-7; regulation by elec. and mechan. devices, Engle, *Elec. World*, Mar. 12; reg., Butz's, Sep. 24-7.

" NEW prin. of measuring, *Sci. Am. Sup.* Sep. 27; conduct. power of materials, Coleman, Nov. 1-4; units of living being, registering ap. for, D'Arsonval, July 3; dissociation temps. and pyrotechnics, F. Siemens, July 10; action of stm. on combust. of carb. oxide and hydrogen, Aug. 14-6; heat photography, Ives, Apr. 23-7; conduct. power of materials, *Eng.* Sep. 5-4; high temps., thermo-elec. measurement of, Chatelier. Mar. 11-7.

HEATING AND VENTILATION. See also HEAT; STEAM HEATING.

" BUILDINGS, quan. air required, *Eng. News*, Dec. 26-5; hot water, Boston Co.'s sys. Aug. 27-7; do. Daniel's, *Iron Age*, July 29-6; adapt. of stm. b's. for warming dwellings, J. W. Anderson, *Am. Eng.* June 5-5; water, flame contact, Fletcher, Aug. 4-6; and ventil., Billings, *San. Eng.* Jan. 11, Feb. 8, Mar. 15, Apr. 12, May 31; doctor's, h. Mar. 8; school bu. Mar. 8; Soldier's Home hos., Washington, Mar. 15; Ogdensburg opera h. Mar. 22; prison, Apr. 26; N. Y. hos. buildings, May 31; Met. opera h., N. Y. Dec. 6-3; sys. for houses in Germany, Sep. 18-4.

" NAT. SOLDIERS HOME hos., Va. *San. Eng.* Sep. 3; bu's, quan. air required in, Hartford, Oct. 8; Berlin H. of Parliament imps., Grove, Dec. 31-5; Chamber of Deputies, Paris, Joly, rep. July 22; relative econ. of by heated chimneys and fans, W. P. Trowbridge, July 29; trap syphonage, expts., G. Brown, U. S. rep. Dec. 11, arr. of Vienna Orpheum, Leschetizky; Dec, 25-6.

" HOT WATER, in a barn, Jan. 1; do. of State, War & Navy Dept. bu., Washington, Jan. 22; do. of P. O., Customs & Inter. Rev; govt. bu., Woodstock, N. B. Feb. 5, 19; hot water b. Mar. 19; hot water and fitting, Apr. 9, 23, May 14, June 4, 11, July 23, Aug. 20, Sep. 3-24; and ventil., Honesdale school, Apr. 30; hot water and stm., comp. value for heat and power transmiss., Emery, June 11-7; and ventil., hot water, Westchester cty. almshouse, *Eng, & Bu. Rec.* Dec. 3-7.

" THEATRE, Seddon, *Van Nost.* Apr; warmth and lighting, Galton, Oct.-4; of bu's., Porter, Jan.-5; do. *Bu. News*; hot water, *St. Ry. Gaz.* June-6; water, (Prall sys.), Boston Heating Co.'s plant, *Elec. World*, Nov. 12-7; ventil. and obstructed air, vital discovs. in, Conant, *Sci. Am. Sup.* June 9; ventil. by coal gas, Humphreys, June 30; heating by gas, Gomez's ap. Dec. 29-3; and ventil. Jan. 23; hot water, flame contact, T. Fletcher, July 17; heating, flame, applic. of, Lodge, Aug. 7-6.

" HOT WATER, Prall sys., rep., Isherwood, *Mas. Stm. Fitter*, July-7; do. Emery, *Trans. Am. Soc. M. E.*-7; and ventil. hints, *Locom.* Dec.-6; do. *Pop. Sci. M*; and ventil. of aparts., util. of suns rays in, E. S. Morse, *Soc. Arts*, Apr. 9; (warming) of bu's, applic. of solar heat to, Woodbridge, Nov. 12-5.

HEATING AND VENTIL. by radiation, Head, *Eng.* Feb. 27-5; and ventil., air required in bu's, Hartford, *The Eng.* Nov. 13; ventil., and lighting of Bristol Council Hall, H. Shaw, Nov. 13-5.

HEMP TRADE, U. S. *Iron Age*, Feb. 3-7.

HENRY, JOSEPH, and magnetic teleg., Dickerson, *Sci. Am. Sup.* June 26-6.

HENRY MEMORIAL TABLET, Princeton, addr., Dickerson, *Electric.* July-5.

HEREDITY, Weismann, *Sci. Am. Sup.* Feb. 26-7.

HOIST, friction, Jones', *The Eng.* Mar. 23-3. See also ELEVATORS.

HOISTING ENGINE, double, *Am. Eng.* June 27-4.

HOLLAND, coast surveys, *Eng. News*, Jan. 9; coast fortifications, May 1-6.

HOLMES, CHAS. B., *St. Ry. Gaz.* Nov.-7.

HOLMES, OLIVER WENDELL, *Sci. Am. Sup.* Aug. 7-6.

HONG-KONG, U. S. trade with, *Iron Age*, Aug. 26-6.

HOOK CONSTRUCT. *Am. Eng.* July 13-7.

HOOKE, ROBERT, *Sci. Am. Sup.* Sep. 1-3.

HOOKS AND EYES MACH. *Mech.* Feb. 23-4.

HORSE, shoe, antiquity of, *Iron Age*, Nov. 22-3; construct. of foot, *St. Ry. Gaz.* July-6; shoeing, hist. and principles of, Keil, *Sci. Am. Sup.* Mar. 31; Am. trotting, evolution of, Brewer, May 26-3; Melton, winner of Derby, '85, Aug. 1-5.

HORSES, trotting stat., table, *Sci. Am. Sup.* Mar. 24-3; Govt. cavalry, breeding farm for, Robertson, Aug. 13-7. See also RYS., ST., HORSES.

HUDSON BAY & STRAIT route, Coats, *Eng.* July 22-7.

HUTCHINSON, ROBERT, por. *St. Ry. Gaz.* Apr.-7.

HUXLEY, THOS. H., por. *Sci. Am. Sup.* Sep. 1-3.

HYDRAULIC ENGINEERING, flow of water thro. pipes, tables, McAlpine, *Eng. News*, Jan. 13, Mar. 3, 10; Green's pond imp., Long Branch, N. J. June 9; power supply, Ellington, Nov. 17-3; power distrib., London, Aug. 23; flow of water, expts., Weston, Sep. 27; mud, sand and gravel transport. by running water, Vauthier, Nov. 1-4.

" ENG., lift and mud receiver, Powell, *Eng News*, Feb. 7; power, Ellington, May 16, 23; St. Anthony falls, Aug. 8; gauging of flowing water, Turner, Aug. 15-5; pump, Johnston, Jan. 22-7.

HYDRAULIC ENG., mach. *Iron Age*, Apr. 19; wk., notes on rolling mill, Nov. 15-**3**; jack, Nov. 13-**4**; ram, May 13; press for prismatic gunpowder, June 10-**6**; power in Germany, July 21-**7**.

" ENG., discharge of water thro. apertures, table, *Mech.* Jan. 13; mach. Tweddell, Apr. 28; flow of elastic fluids thro. orifices, June 16; wk., notes, Nov. 10-**3**; flow of water thro. pipes, Weston (Am. Soc. C. E.), Oct.-**4**; putting bolts thro. retaining wall under water, proc., Reynolds, Sep; lifts, French and Belgian, Nov.-**5**; aut. flood gate, Czvetkovic, inv. *San. Eng.* Nov. 19-**5**; jack, *Am. Eng.* Oct. 24-**4**; ram, Mar. 18-**6**; lifting jack, Tangye, *Ry. Gaz.*, Feb. 16-**3**; jack, Giant, Nov. 20-**5**.

" ENG., tables, Kutter's formula, Flynn, *Van Nost.* Feb, May; expts., Cunningham, Apr.-June; current-meter measurements, Rhine r., Baum, Aug.-**3**; architecture, Jan.-**4**; do. *Builder*.

" ENG., measurement and flow of water in ditches, Bowie, *Van Nost.* Jan; do. Browne, May; do. Pierce, June; do. Emery, Apr., n. June; use of double floats for measuring vels. in large streams, Bazin, Feb; propulsion, Barnaby, Apr. May; flow through submerged outlets, Salles, June; tables, based on D'Arcy's formnla, Flynn, June; Darcy's formulas applied, Hill, Dec.-**5**; flow of water over submerged weirs, Sawyer, Mar; Kutter's formula, Flynn, Apr; do. n. Sep.-**6**.

" ENG., vel. of approach in weir comput. *Fran. Inst.* Aug; back water from dams, Nov.-**4**; coef. of efflux, short pipe, Oct.-**6**; reaction of liquid jet, Webb, Aug; impact water on plane surfaces, expt. verifying Weisbach's formula, W. C. Smith, Oct; loss of head in, Church, Nov; reaction of liquid jet, Webb, Dec.-**7**.

" ENG., mach., Perry, *Sci. Am. Sup.* Jan. 6, Feb. 24; mach. tools, Tweddell, Apr. 28; press, Brinck's, June 2; fan brake, Aug. 4-**3**; pump, Roux's, July 5; two manners of motion of water, Reynolds, Aug. 9; parachute motor, Jagu's, Sep. 20; do. Yagu's, Nov. 15-**4**.

" ENG., elevator at Fontnettes, Neuffosse canal, *Sci. Am. Sup.* Feb. 21-**5**; ram, Pearsall's, June 5; comp. press, Oct. 2; blower, "Trompe," Oct. 16-**6**; hydrographic surveying, Bradford, Apr. 23-**7**.

HYDRAULIC ENG., motor, oscillating, Schaltenbrand, *Sci. Am. Sup.* Sep. 17; drilling mach., Toulon dock yard, Oct. 29; submarine mining, hist., Rodman, Nov. 26, Dec. 3-**7**; topog. meths. of U. S. Coast and geod. survey, Burton, *Soc. Arts*, Apr. 26-**3**.

" ENG., power distrib. *Eng.* Oct. 26-**3**; current meter tests, May 23; Hydr. Eng. Co. Sep. 5-**4**; hydro-mech. physiography, Evans, Jan. 30; motor, Donaldson, Feb. 20; power supply, Ellington, Mar. 13-27; mach., Inv's exhib. May 1-**5**; ram, Pearsall, Apr. 9; cotton press, Watson, Aug. 27; expts. Oct. 15-**6**; power wks. at Niagara falls, proposed, Jan. 14; jack, Tangye, June 3-**7**.

" ENG., pump, Roux, *The Eng.* May 23-**4**; lifting mach. and coal hoist, Boston docks, Jan. 9, 23, 23; mach., Buenos Ayres port, Feb. 6, and engs. Mar. 6; rams, force of, E. B. Weston, Feb. 20; power supply, Ellington, Mar. 20, Apr. 10; eng., Hastie's, June 12; aut. flood gate, Czvetkovic's, Aug. 14; forging press, Tweddell's, Sep. 25; pumping eng. Sep. 25; flanging mach. Sep. 25; formulas, Donaldson, Oct. 2; pump, Broxburn Coll. Oct. 2; forging press, Berry's, Oct. 30-**5**; concrete lowering proc. under water, Jan. 29; mach. for slipway at Hiogo, Jap. govt. Feb. 12-**6**; pipe testing ap. Sep. 30-**7**.

HYDROMETER, Bate's, *Eng.* May 11-**3**.

HYDRO-DYNAMIC RESEARCHES, Bjerknes', Cooke, *Sci. Am. Sup.* May 9, 30, Aug. 1-**5**; do. *Eng.* Mar. 27, Apr. 10, 24-**6**.

HYGIENE, our clothing and h's. *Fran. Inst.* Oct.-**4**. See also HEALTH.

ICE, strength of, *Eng. News*, Dec. 26-**5**; age, in Peru, *Fran. Inst.* Apr; mining and storing, Nov.-**3**; harvest of Am. *Eng.* Nov. 30-**3**.

" MACH., Ballantine, *Iron Age*, Sep. 11-**4**; Pictet, *Mech.* Jan. 26; French, July; Ballantine refrig. plant, Sep.-**4**; and refrig. ap., Lightfoot, *Van Nost.* Aug, Sep.-**6**; making mach. *Eng.* May 28, June 18; July 2, 9, 23; Oct. 1-**6**; Pontifex, Apr. 1-**7**. See also REFRIGERATING MACH.

" PALACES, *Mech.* Aug.-**5**; yacht construct. *Sci. Am. Sup.* Dec. 17-**7**.

INCUBATOR, rep. *Fran. Inst.* Mar.-**6**.

INDEX, card catalogue as an, *Eng. News*, Mar. 31-**3**; to periodical literature (begins), Feb. 21 &c.-**5**; card catalogue, *Ry. Gaz.* Mar. 30; do. sys., R. classification, Berg, Apr. 6-**3**.

INDIA, *Iron Age*, Aug. 23-3; survey of, J. T. Walker, *Van Nost.* Jan.-6; pub.wks. dept. *Eng.* May 2-4; iron working, Mar. 5-6.

" BRITISH, U. S. trade with, *Iron Age*, Jan. 7-6; Aug. 11-7.

INDIAN CASTINGS, *Iron Age*, Jan. 6-7; C. P. Clarke, *The Eng.* May 28-6.

INDIGO MANUF., Ransom, *Sci. Am. Sup.* Jan. 8; in India, Oct. 8-7.

INDUSTRIAL HYGIENE, Gerhard, *Mech.* Apr.-7.

INFERNAL MACHINES, *Iron Age*, June 7-3.

INJECTOR, Gastine's traction (for insects destroying), *Sci. Am. Sup.* Jan. 10-5. See also STEAM BOILER INJECTOR.

INSTINCTS, human, James, *Pop. Sci. M.* Sep.-7.

INTEREST, rate of, in Europe, *Iron Age*, Feb. 11-6.

INTERSTATE COMMERCE, bill, U. S. *Iron Age*, Feb. 3-7; doc. *Mech.* sup. Mar.-7; text, *Ry. Gaz.* Dec. 31-6; commiss. rep. Dec. 9-7.

INVENTION, art of, *Mech.* Oct. 13-3; do. *Elec. Rev*; Seely, *Electric.* July-6; inventing, an analytical and systematic method of, E. P. Thompson, *Elec. World*, Nov. 22, Dec. 20-4; do. do. Jan. 17, Feb. 7, 14, Mar. 14, May 2-5.

INVENTIONS, and leading patentees, '83, *Iron Age*, Oct. 16-4; chance, *Mech.* Jan. 19; of Watt, Jan. 12, 19, Feb. 2; and patentees of '83, Oct.-4; and pats. *Ry. Gaz.* Feb, 16-3; influence of on civilization, C. Smith, *Soc. Arts*, Feb. 14-4; of Watt, *Eng.* Nov. 30, Dec. 7-3. See also PATENTS.

INVENTORS, unfortunate, *Iron Age*, Aug. 13-5.

" INSTITUTE, *Sci. Am. Sup.* Jan. 3-5.

IRON AND STEEL. See also STEEL.

" AND STEEL INST., England, pors. *Sci. Am. Sup.* Oct. 29-7; *Eng.* May 11-3; pro. May 2, 9, Sep. 26, Oct. 3-4; May 8-29, June 5, 12, Sep. 4, 11-5; May 21, 28, Oct. 15, 22-6; May 27, June 3, 10, Sep. 23, 30-7; *The Eng.* May 11, 18, Sep. 21, 28, Oct. 5-3; May 2, 16, Sep. 26, Oct. 3, 10-4; May 15, 22, Sep. 4, 11-5; May 14-28, Oct. 8-22-6; Sep. 23-7.

" PRESERV., Bower-Barff proc. *Eng. News*, Nov. 24-3; do. blast furnace with bosh water-jacket and iron top, Wendt, Sep. 6-4; do. cast wk., designs, C. W. Trowbridge, May 16; industries, rep., Cope, June 27-5; working stress of, B. Baker, Dec. 18-6; iron trade, Am., '86, Swank, Jan. 8; do. rolled beam manuf., Belgium, n. Mar. 12; effect of temp. on, Ramsey, Dec. 3-31-7.

IRON AND STEEL, trades, '82, Brit. review, *Iron Age*, Jan. 4; crystallization of, A. F. Hill, Jan. 4; iron, trade of world, Jan. 4; do. pig, produc., U. S., table, Feb. 15, Mar. 22; do. trade of Grt. Brit. Feb. 22; micros. anal. of, Bayles, Mar. 1; iron, cast, enamelling, Mar. 8; U. S. imports and exports, May 15; Bower-Barff proc., Bower, Mar. 15-3.

" IRON, indus., Sweden, *Iron Age*, Apr. 5; do. trade manuf., '82, Grt. Brit. Apr. 19; crystallization, A. F. Hill, Apr. 19; stat., '82, Apr. 26; iron, trade stat., Brit. May 3; do. consumption per capita, of world, May 10-3.

" BLAST FURNACES, working, Cochrane, Apr. 26; gas seals on, Uehling, May 3; practice, May 31, June 7; Jan. 18, Apr. 19, June 14; reducing fuel consump., Brown, June 21; idle, June 21; high and low temp. working, July 5; condition, July 16, Oct. 11, Nov. 22; Crozer Steel & Iron Co., Roanoke, Va. Sep. 20; econ. in relation to design, Nov. 1; Cowper stoves, Dec. 6-3.

" IRON WORKS., blowing engs., French, *Iron Age*, June 14; do. manuf., gaseous fuel in, July 12; do. pig, produc. July 26; do. smelting, heating arr. for, July 19, 26; do. pig, trade, Aug. 9; do. Belgian manuf. Aug. 16; do. wk. preserv. Aug. 23; do. Krupp's wks., Essen, Ger. Aug. 23; do. det. of manganese in spiegel, etc. Aug. 30-3.

" IRON, puddling, mechan. *Iron Age*, Sep. 6; do. steel and metals, cause of magnetism in, Sep. 6; German Ry. tests for, Sep. 13; iron, wrt. manuf., Chapin pneu. proc. for, Sep. 13; do. manuf. in Maryland and Penn. in 1734, Sep. 13; do. fields of Sweden, Sep. 27; do. founding, coal and coke for, Sep. 27; do. and coal produc., German, Oct. 4; gases in, Oct. 4, 11; iron, ores, carbonate, kiln for roasting, Oct. 18; trade, Brit. Nov. 29; iron, ores, chem. anal., compar. value of, Dec. 13-3.

" BLAST FURNACES, condition, U. S. *Iron Age*, Jan. 10, 24, Apr. 10, June 12, July 10, 31, Aug. 7, Sep. 11-25, Oct. 9, Nov. 13, Dec. 11; action of phosphorus, Jan. 10; iron ores, value of, Feb. 14; York, Feb. 28; Weimer's water cooling ap. May 1; Citico, May 1; So. West. Va. May 15; use of raw coal in, May 15; plant, 29-4.

" IRON, foundry hydraulics, *Iron Age*, Feb. 21, Mar. 27; do. pig, produc. Jan. 31; do. do. U. S.,'82 and '83, Feb. 14, Mar. 13, Apr. 3; do. do. produc. and stocks of, Brit., '83, Apr. 3-4.

IRON AND STEEL, iron, furnace, cupola, Ibrugger, *Iron Age*, May 29; trades, Brit. review, '83, Jan. 3; fluctuations in prices since 1872, Jan. 3; expts., Brit., '83, Jan. 31; foreign trade, '83, Mar. 13-4.

" IRON, expts. on secretion of gas in, *Iron Age*, Apr. 3; production, France, '83, Apr. 17; physical condition of, Apr. 24; iron furnace, gas puddling and heating, Smith-Carson, Apr. 10; do. do. cupola, English practice, May 1; do. do. reverberatory, Stubblebine, May 8; production, stat., U. S., '83, May 8; iron, districts of Grt. Brit. May 15; do. making in South, May 22; do. production, East and West, May 29; do. rolling mill eng., German, June 5-4

" IRON mines, Lapland, *Iron Age*, July 31; do. foundry practice, English, Aug. 28; wks., Ebbw, Sep. 4; manuf. Sep. 4; wks., Dowlais, Sep. 4; iron, charcoal, indus. Sep. 25; do. pig, U. S. imports, Sep. 25; do. furnace crane, Sep. 25; do. Swedish, indus. Oct. 23, 30, Nov. 6; do. Nat. Charcoal Assoc. Oct. 9; do. furnace, heating regen. gas, Oct. 30; do. do. regen., Dick and Riley, Oct. 30; indus., extent, U. S. Oct. 30; iron, pig, profit in manuf. Nov. 20; ladle carriage, English, Nov. 27; iron foundries, Chinese, Dec. 11-4.

" BLAST FURNACES, condition, *Iron Age*, Jan. 22, Feb. 12, Mar. 12, Apr. 9, May 14, June 11, July 9, Aug. 6, Sep. 10, Oct. 8, Nov. 12, Dec. 10; Avesta proc. Mar. 19; Salisbury iron region, Feb. 5, Mar. 26; gases, Apr. 2; English and Am. practice, Apr. 30, May 7; regen. hot blast oven, Long, May 21; iron ore and fuel in, May 21; value of coke, May 28; a water jacket, June 18; English practice, July 16; Durham iron wks., Pa. Sep. 24; old charcoal, Oct. 8; wks., No Chic. Rolling Mill Co. Oct. 22; Am. distrib. and proportions of, Dec. 24-5.

" IRON, in modern architecture *Iron Age*, Jan. 1; trades, Brit. review of, Jan. 8; iron, hot blast oven, Shelby Co., Ala. Jan. 15; do, cinder pig, Jan. 29; do. ore, L. Superior, '84, Jan. 29; do. pig production, '84, Feb. 12; do. ornamentation, Feb. 19; Germany, Feb. 19, May 7; iron, pig, U. S. districts, Mar. 19; do. castings, wts. of by measurement, Mar. 26-5.

" IRON, wks., Jefferson, O. *Iron Age*, Apr. 2; do. foundry, ancient practice, Apr. 16; do. bar, etc., wt. tables, Apr. 23; do. pig, English, Apr. 30-5.

IRON AND STEEL, bars, imported, price, U. S. *Iron Age*, May 7; iron ore and fuel consumpt., '84, May 21; iron manufs. wages scale, May 21; Am. produc., stat., '84, May 28; iron, wrt. castings, Mitis, June 4; preserv., Bower-Barff proc. June 11; iron, pig, cost of production, June 18; do. Clapp-Griffith's proc. Apr. 16, 30, June 25; do. do. plant, Pitts. Mar. 12-5.

" IRON, sheet, galvanized, *Iron Age*, July 23; production, July 30; English exports, July 30; micros. structure of, Aug. 13; iron, sheet rolling, wages in West, '79–'80, Aug. 20; do. wages, English, Aug. 20; do. wks., English in Russia, Aug. 20; Ferro-manganese, and manuf. Aug. 20; iron, manuf., Sweden, Sep. 3; do. wks., Krupp's, Germany, Sep. 10; do. wks., German, wages and profits, Sep. 10; and copper, effect of heat and cold on, Sep. 17; iron wks. at No. Chic. Rolling Mills, Sep. 17; ship bu., Germany, Sep. 24-5.

" IRON, castings, light wks., Hopson and Chapin, *Iron Age*, Oct. 1; do. founding, value of silicon pig, Oct. 1; do. structures, intermittent strains on, Oct. 8; do. foundry wk., cost of production in, Oct. 8; do. hot blast stove, Cooper, Oct. 15; do. ore smelting with petroleum, Weber proc. Oct. 29-5.

" IRON, beams, *Iron Age*, Nov. 5; mechan. puddling, Otis wks. Nov. 5; iron furnace, cupola, Ibuegger tests, Nov. 5; do. do. Riley open-hearth, Nov. 12; exports, Nov. 12; do. hot blast stove, Gordon, Dec. 3; do. plate bending rolls, English, Dec. 10; do. forgings, heavy, manuf. of, Dec. 24; do. and coal trades, Sweden, Dec. 31; do. pig, and steel production diagram, '72–'85, Dec. 31-5.

" BLAST FURNACES, U. S. condition, *Iron Age*, Jan. 7, Feb. 18, Mar. 11, Apr. 8, May 13, June 10, July 8, Aug. 12, Sep. 9, Oct. 14, Nov. 11, Dec. 9; distrib. and proportions of Am. Jan 7; Brit. Feb. 25; reconstructed, Shelby, Ala. Apr. 1; coke and charcoal as fuel for, Apr. 8; charging ap., Uehling, Apr. 29; records, comparisons, July 8; repairing linings, Dec. 2-6.

" BRIT., annual review of, *Iron Age*, Jan. 7; iron, trade, Austrian Jan. 14; do. foundry, sand moulding mach., Aiken's, Jan. 21; do. pig, production in '85, Jan. 28, 28; do. furnace production, No. Chic. Rolling Mills, Jan. 21, Feb. 4; do. roasting furnace, Davis-Colby, Feb. 11; imports, '85, Feb. 11; iron, furnace, Anniston, Ala. Feb. 18; do. ore quarry, Cranberry, N. C. Feb. 26-6.

IRON AND STEEL, Am. Inst. Mining Engs., *Iron Age*, Feb. 25, Mar. 4, 11; iron, pig, protection of, Mar. 3; do. manuf., profits of in Germany, Mar. 4; do. charcoal, region of South, Mar. 18; do. Grt.Britian's interest, a century and a half ago, Mar. 18; do. castings, Mitis, from wrt. iron or steel, Mar. 25; Krupp's great wks., Essen, Ger. Mar. 25-6.

" IRON, foundry, rel. value of coal and coke, *Iron Age*, Apr. 15; production, Grt. Brit. Apr. 29; Am. stat., '85, May 6; imports and exports, May 6; production manganese ores, U. S. '85, May 6; iron rolling mill, Seaman, May 6; 6 months output in Grt. Brit. Sep. 2; iron rolling mills, U. S., capacity, Sep. 29; do. do. engs. Sep. 9-6.

" IRON, hardening furnace, Herzog's, *Iron Age*, Oct. 14; recent imp. in basic proc. Nov. 11; iron wks., John Cockerill, Seraing, Nov. 11; do. So. Boston, Nov. 18; iron, pig, advance in, Nov. 25; notes on working stress of, Dec. 9; iron, trade, Southern, growth of, Dec. 9; do. nuts, manufs. standard, Dec. 23; do. rolling mill, steel rail, capac. of, Dec. 23; do. do. Bean's & Martin Rod, Dec. 30-6.

" BLAST FURNACES, U. S., condition, *Iron Age*, Jan. 13, Feb. 10, Mar. 10, Apr. 14, May 12, June 9, Aug. 11, Sep. 15, Oct. 13, Nov. 10, Dec. 15; capacity, U. S. Jan. 6; heating, effect on composition of pig, May 5; hoist, Fayette, July 21-7.

" IRON range, Gogebic, Birkinbine, *Iron Age*, Jan. 6; do. pig production, U. S., 86, Jan. 20, Feb. 3; do. do. Grt. Brit. Jan. 20; do. trade, English, '86, Feb. 3; production, Germany, '85, Feb. 10; iron, roofing corrugating mill, Daelen, Feb. 17; do. ore smelting in U. S., Birkinbine, Mar. 10; foreign, sources of, U. S. supply of, Mar. 10; iron, slag and metal tilting car, Weimer, Birkinbine, Mar. 10; do. manuf. in Germany, Mar. 24-7.

" IRON, pig, making in South, Pierce meth. *Iron Age*, Apr. 7; do. drawing proc., flow of metals in, O. Smith, Apr. 7; production, France, Apr. 7; iron, range, Gogebic, Apr. 14; do. mines of Minnesota, Birkinbine, Apr. 14, 21; production, '86, Apr. 28; do. wks., U. S., table of, Apr. 28; do. wages, Sheffield, June 2; do. ingot manipulator, Robinson, June 2; do. and manganese ores in No. Car. and Ga., Birkinbine, June 2; do. casting upon lace, Outerbridge, June 9; do. manuf., wages, June 23; do. industry of Bilbao, June 30-7.

IRON AND STEEL, iron, pig, U. S. rank in, *Iron Age*, Aug. 11; do. swaging mach., Dayton, Excel. Needle Co. Aug. 18; do. charging ap., Lucy fur., Kennedy, Sep. 1; do. duties, Canadian, Sep. 1, 8; do. masters, Am., Potter, Sep. 22; do. gas furnace, McKenna, Oct. 13; do. furnace plant, Tenn. Coal, Iron & R. Co., Ensley City, Ala. Nov. 3; do. wks. Cambria, Pa. Nov. 10; do. Charcoal Workers Assoc. pro. Nov. 24, Dec. 1; do. making in Birmingham district, Dec. 8–22; do. ores of U. S., Birkinbine, Dec. 29-7.

" IRON, crystallization, *Mech.* Feb. 3; do. A. F. Hill, Apr. 28; iron, plate shearing mach., Donnay, Feb. 17; do. foundry cupolas, consumpt. of fuel in England, Mar. 3; do. rustless, Bower-Barff proc. Mar. 10; micros. anal. of, Bayles, Mar. 10; effect of repeated heating on, Barnaby, May 19; iron, foundry, elbow moulding without pattern, Radcliff, Sep. 15; do. do. moulding elliptical forms do. Dec. 1-3.

" IRON, cupola, Stewart, English practice, *Mech.* Mar. 22; do. rolling mill eng., vertical, German, May 31; do. furnace, cupola, Ibrugger, June 14; do. foundry, moulding and casting a 20-inch center-valve, Radcliff, Oct; do. and wood tests, Watertown mach. rep. Nov.-4.

" IRON, castings, wts. by measurement, *Mech.* Jan; do. foundry practice, ancient, May; do. armor plate manuf., Brink, Aug, Sep; do. wrt. castings, Mitis, Nordenfelt, Nov; do. wrt., crystallization of, Hill, Dec.-5; do. moulding, loam, imp. Feb; do. foundry, West, Apr.–July, Sep.-6.

" IRON, blast furnace b's and settings, Gordon, *Am. Eng.* Mar. 21, 28, Apr. 4; do. wrt. manuf. direct from ore, W. P. Ward, May 2, 9; Bayles, June 6, 13; iron, foundry cupola furnace, Blackeney's, Dec. 19-4; do. wk. ornamentation, Julian, Mar. 13; Gordon converter, May 22; iron, Bower-Barff proc. for oxidation of metals, Weightman, May 29-5.

" IRON, blast furnaces, Brit., number, *Am. Eng.* July 10; do. foundry, wk. es. sys., Messerschmidt, July 23, 30, Aug. 6–27; do. do. sand moulding mach., Rice, Sep. 24; do. do. cupola fur., J. Riley, Sep. 24; do. do, value of silicon pig, C. Wood, Oct. 8; do. blast furs., Am., distrib. and proportions of, Birkinbine, Dec. 24, 31-5.

" IRON, test specs., Pittsburg, A. E. Hunt, *Am. Eng.* Apr. 15–29; do. foundry patterns, metal plate wks., C. T. Millis, June 10–30, July 7–28, Aug. 4–18-6.

IRON AND STEEL, iron, blast furnace accessory products, Blair, *Am. Eng.* Aug. 11, 18; do. castings, malleable, Sep. 22-**6**; do. do. *Mech. Prog.*

" IRON, change of elastic limit by drawing, heating and repeated loads, Bauschingen, *Am. Eng.* Jan. 26; iron, founding, Crane, Feb. 2–23, Mar. 2–30, Apr. 6, 20, 27, May 4–25, June 1, 22, July 6, 13, 27, Aug. 3–24, Sep. 28, Oct. 12–26, Nov. 9-**7**.

" IRON, manuf., econs. in, A. E. Tucker, *Am. Eng.* Feb. 23, Mar. 2; do. forges, Buffalo heating, Apr. 6; do. casting on lace and other combust. materials, Outerbridge, June 15; do. pure, properties, Adamson, July 6; production, U. S., '86 and '56, Aug. 17; iron, foundry patterns, metal plate wk., C. T. Millis, Oct. 12–26, Nov. 2–16, Dec. 21; do. wrt. Dec. 21-**7**.

" IRON, industry. *Ry. Gaz.* Nov. 23-**3**; do. pig production, U. S. Feb. 15-**4**; do. trade review, '85, Jan. 8; blue heat, effect of, Stromeyer, Feb. 19-**6**; trade, U. S., '86, Jan. 7; iron blast furnaces, early, Feb. 11; working stress, B. Baker, Feb. 18; prices, '85–'87, Aug. 26-**7**; micros. structure, Sorby, *Van Nost.* Jan; relation of manganese and carbon in, Pourcel, Feb; notes, Apr; corrosion of, Gruner, Sep, Oct; Bower-Barff proc., Bower, Nov; mild, expts. Nov; tests, German Ry. Dec.-**3**.

" CORROSION tests, Phillips, *Van Nost.* Feb, Mar; physical condition, Hughes, Mar; Bayles, Sep.-**4**; iron, cast, malleable, tests, Ricketts, Apr; do. do. properties of, July; tests, proof, June-**5**; corrosion, Parker, Mar; iron, corrosive effects of steel on, in salt water, Farquharson, Mar.-**6**.

" CLASSIFICATION, Kent, *Ry. & Eng.* Apr; prices, June; iron blast furnaces, U. S. July, Aug. and files; production, U. S., '56 and '86, Sep.-**7**; iron, annealed, *Fran. Inst.* June-**3**; do. forging, distrib. of heat of, Apr.-**4**; strength on heating, Apr; micros. structure of, Oct.-**5**; iron, blast furnace, May; do. car wheel, micros. structure, Aug; castings, Mitis proc. Nov.-**6**; micros. structure, Garrison, Mar; iron blast furnace crucibles, Hartman, Dec.-**7**.

" DIRECT PROC., Bull's, *Sci. Am. Sup.* Apr. 14; Samuelson, Jnne 9; iron, forging, heat developed in, Tresca, Dec. 15-**3**; do. indus. in Brazil, Ferrand, Mar. 29; do. foundry cupola, Thwaite's, Apr. 5; do. wrt., manuf. from ore, W. P. Ward, June 14-**4**.

IRON AND STEEL, iron, blast fur. slag refining, Elbers, *Sci. Am. Sup.* Jan. 31; do. preserv. by iron oxide, Thwaite, Feb. 28; do. rustless, Bower-Barff, Kidder, June 20; do. and coal districts of Ala. Aug. 1; do. foundry cupola fur., Riley's, Oct. 31-5; do. heavy forgings manuf., Putnam, Jan. 2; do. blast fur. fuels, charcoal and coke as, Belani, Sep. 11; do. stove, hot blast fire-brick, Massick, Nov. 20-6.

" IRON, blast furs., Walsh, *Sci. Am. Sup.* Jan. 8; do. wrt. wk., Gardner, June 11; do. and other metal casting on lace and other combust. materials, Outerbridge, July 9; composite, G. Allen, July 23; anal., J. J. Morgan, July 23; iron, electro-deposition of, Aug. 6; do. wrt., Chapin, Searles, Oct. 1-7.

" CRYSTALLIZATION of, A. F. Hill, *Soc. Arts*, Apr. 12-3; iron, preserv, *Locom.* Sep.-3; do. pig, production cost, Moorhead, Apr; do. manuf. of Ohio, Lord, Aug.-4; do. safety of, fictitious cœffs. of, Jan; do. castings, Mitis wrt., Nordenfelt, June-5; effects of blue heat on, Stromeyer, Apr.-6; iron, trade production, U. S., '86, stat. Apr.; do. foundry moulding sand, June; do. blast furs. in U. S., condition, coal and coke, tables, Oct.-7.

" BLAST FURNACES, working, *Eng.* Feb. 2; gases as a source of ammonia, Mar. 9; econ. May 18, Sep. 21, 28; Cowper stove, Sep. 21-3.

" IRON, pig manuf. in Sweden, *Eng.* Jan. 26; do. Brit. trade, '82, Feb. 9; do. pig breaker, Blake's, Mar. 2; effect of repeated heating, Apr. 20; rolling mill reversing engs., Nova Scotia Co. May 4; iron, produc., '82, June 1; do. wks., John Cockerill, Séraing, Belgium, Aug. 3; do. and coal trade, Belgian, Aug. 3, 24; do. Founders Soc. Aug. 31; do. Moulders of Scotland, Sep. 21-3.

" IRON, blast fur. econ., Houson, *Eng.* Feb. 1; do. do. use of raw coal in, Bell, May 2, 9; do. do. Ebbw Vale, Aug. 15; do. fur. cupola, Stewart, Jan. 18; physical condition, Hughes, Feb. 8; wks., Ebbw Vale, Aug. 8; do. Rhymney, Aug. 1, 8; do. Dowlais, Aug. 8; iron, fur. regen., Riley and Dick, Sep. 26; do. wks., Dee, Oct. 10; do. heated, vapors of, Oct. 17; smelting cupola, Gmelin, Oct. 31-4.

" IRON, blast fur., tar and ammonia from, Jones, *Eng.* Oct. 16 23, Nov. 6; do. castings, wrt., Mitis, Nordenfelt, May 15; do., wks., Spittlegate, July 24; do. and wood wks., Sheaf, Lincoln, Ruston, July 31-5.

IRON AND STEEL, iron wks., Britannia, Gainsborough, *Eng.* Aug. 7; do. industry of Frodingham, Dove, Aug. 21; do. pig, silicon, Wood, Sep. 11; do. furs., cupola, Riley, Sep. 18; do. plate straightening mach., Britton, Inv's exhib. Oct. 2; do. trade of Scotland, Oct. 2, 9-5.

" IRON, blast fur. practice, Am. *Eng.* Oct. 29; do. do. Nov. 19; effects of blue heat on, Jan. 29; iron, rolling mill, cruciform sections, Jan. 29; tests, Feb. 12; test recording ap., Buckton, Feb. 19; iron, foundry tilting ladle, Burrows, Feb. 26; do. working, India, Mar. 5-6.

" IRON, castings, Mitis, *Eng.* Apr. 9; iron forging press, 4,000-ton hydr., Cammell, Apr. 23; trade, Am. June 11; iron, wks., Bethlehem, June 25, July 2; do. test recording ap., Henning, Aug. 6; micros. structure, Aug. 6; Edinb. exhib. July 30, Aug. 27, Oct. 8; iron wks., Carron, Falkirk, Sep. 3, 10-6.

" IRON, malleable, produc. direct from ores, *Eng.* Oct. 1; Inst., removal of metalloids, Oct. 15, 22; iron foundry pig, silicon in, Oct. 22; foundry iron, do. Nov. 12-6.

" IRON, blast furs., cost of, Samuelson, *Eng.* June 17, July 1; do. trade, Scotch, in '86, Jan. 7; working stress of, Baker, Jan. 21; do. foundry, molding mach., Pneu., Mold. Co. Mar. 4; trades, European, Mar. 25; iron, founding, scientific, Turner, Apr. 1; do. cupola, Herbertz, Tangye, May 20; at Manches. exhib. May 20; Newcastle exhib. June 10; iron, pig manuf., Bell Bros. July 1; composite, Allan, Aug. 19-7.

" IRON, blast furnace working, Cochrane, *The Eng.* Feb. 2; do. manuf'd. product, Brit. n. Apr. 20; do. export, crude, Brit. May 18; do. production by Siemen's direct proc. from magnetic sand, July 6; do. and coal indus., Liege, Laveleye, July 27; do. do. hist., Liege district, Aug. 3; do. hot blast stoves, cal. of heating surface, Dec. 14; do. wks. rolling mill engs., Rhymney, Dec. 14-3.

" WORKS, Reschitza, Hungary, *The Eng.* Jan. 11, 18, Feb. 1, 1, 15, 29, 29; Hughes, Feb. 1, 8; carbon in, Feb. 15; iron, blast furs., Hungary, Jan. 18; do. do. use of raw coal in, Bell, May 2; do. regen. fire-brick stove, Ford, eng. Jan. 18; do. pig produc., Brit. May 23; do. foundry cupola, Stewart's rapid, Thwaite, Aug. 29, 29; do. fur. regen., Riley, Dick's, Oct. 3-4.

IRON AND STEEL, iron found. cupola, Gmelin's, Jan. 2; do. and coal dists. of Ala. June 5, 19, July 3; do. trades employers assoc., number employed, Aug. 7-5; wks., Athus, Jan. 22, 22, July 9; iron, metal and coal indus., Russia, Mar. 19; Mors Bay Co's wks. Nov. 5; wks., Corngreaves, New Brit. Iron Co. Nov. 26; iron, wks., at Ruabon, New British Co. Nov. 12; do. castings, wrt. iron, Mitis, Dec. 3; do. and coal indus. stat., Belgium, Dec. 24-6.

" IRON, trade, Ger., '86, consular rep. Jan. 14; wks., Athus, Belgium, June 24, Sep. 9, 9; iron, blooming or cogging mill, Head's, Sep. 30; do. found. cupola, Greiner, Dec. 9; do. cast, and steel, internal stresses of, Kalakoutsky, Dec. 9–23-7.

IRONING MACH., Health exhib. *Eng.* Oct. 10-4.

IRRIGATION, in No. Col. *Eng. News*, May 3; eng., canal in West, C. A. Miller, June 28; in India, Ashti tank, Burke, July 19, 26; in So. Africa, Aug. 9; wks., in Italy, Sep. 20-4; in Col., rep. Mar. 28; Egypt, Apr. 18-5; ditches in U. S. Jan. 2; Dorsey, Dec. 4-6; reservoirs, Jan. 8; eng. in former home of Aztecs, Dec. 31-7.

" IN new countries, O'Meara, *Mech.* June 23-3; *San. Eng.* Aug. 5-6; reservoirs for, Torricelli, *Van Nost.* Dec.-6; in N. W. Col., O'Meara, *Sci. Am. Sup.* June 2-3; in Cal., Dow, Jan. 5; wks. in Italy, Nov. 29-4; canals of No. Col. Sep. 11-6; mach. on Pac. coast, J. Richards, Dec. 17, 24-7; do. do. *Eng.* Nov. 4, 18, 25; in lower Egypt, Feb. 25, Sep. 2, 9-7; wks., Nice, Jan. 2, 16-5; N. E. Col., O'Meara, *The Eng.* Apr. 27-3; weir for gauging water, Sep. 17; in Egypt, Saidich Barrage, Dec. 3, 31-6; do. Jan. 21, Feb. 18-7.

ISLANDS, Queen Charlotte, *Eng.* Aug. 15-4.

IVORY, use, Sheffield cutlery trade, *Iron Age*, Mar. 1-3; supply, Africa, Aug. 20-5; do. Nov. 24-7.

JAIL, revolving, Omaha, n. *Eng.* Dec. 18-5.

JAMIN, JULES, por. *Sci. Am. Sup.* Apr. 17-6.

JAPAN, commerce of, *Iron Age*, Aug. 2-3; U. S. trade with, Dec. 18-4; do. June 25, Sep. 24-5; do. Sep. 8-7; prog. in, May 27-6; agric. *Eng.* June 24-7.

JAPANESE, metal work, Dresser, *Iron Age*, Mar. 22-3; magic mirrors, etc., Mendenhall, *Soc. Arts*, Dec. 2-2; pottery, E. S. Morse, Oct. 11-3; arms and armor of ancient, Baba, Oct. 13-7.

JAVA, agric. crisis in, *Iron Age*, Jan. 6-**7**.
JENKIN, HENRY C. FLEEMING, *Electric.* Aug.-**5**; *Eng.* June 19-**5**; *Tne Eng.* June 19-**5**.
JERVIS, JOHN B., por. *Eng. News*, Jan. 17, Nov. 28-**5**; por. *Am. Eng.* Jan. 16-**5**; por. *Ry. Gaz.* Jan. 23-**5**.
JOHNSON, T. L., por. *St. Ry. Gaz.* May-**6**.
JUMBO, elephant, struck by locomotive, *Sci. Am. Sup.* Dec. 25-**6**.

KERPER, G. B., por. *St. Ry. Gaz.* Oct.-**6**.
KIRCHHOFF, GUSTAV R., por. *Sci. Am. Sup.* Dec. 17-**7**.
KIER EXPLOSION, Stainland, *Eng.* Dec. 10-**6**.
KITES, expts., Colladen, *Sci. Am. Sup.* Sep. 10-**7**.
KNEADING MACH., Denel, Purel, *Eng.* Feb. 4-**7**.
KNITTING MACH. *Sci. Am. Sup.* Sep. 1-**3**.
KNOTS, *Eng. News*, Dec. 26-**5**.
KRUPP, ALFRED, por. *Iron Age*, Aug. 25-**7**; and his work as a cast steel manuf. *The Eng.* July 29, Aug. 5, 12-**7**.

LABOR. See also CAPITAL AND LABOR.
" ENGLISH navvy, the, *Eng. News*, Dec. 1-**3**; prices, June 14; do. Paris schedule of, Oct. 11-**4**; occupations of people, U. S., F. A. Walker, May 9; value in differeut countries, Burge, June 27; in U. S., prices, table, Oct. 17, 17-**5**; wages, U. S. and Europe, Jan. 15-**7**; do. in England, Porter, *Iron Age*, Mar. 22; do. in Mass. Sep. 13; prog. in English working classes in last half cent. Dec. 20-**3**; co-oporation at Guise, France, Sep. 4-**4**.
" PRISON, N. Y. State, *Iron Age*, Mar. 5; sliding scales in English coal trade, Oct. 22-**5**; commiss. rep. Apr. 1; do. 1st rep. May 20; trades unions, hist. Apr. 22-**6**; 8 hours a working day, Thurston, *Mech.* Feb.-Jul.-**7**; housing of working classes in England and Wales, Royal commiss. rep. *San. Eng.* Sep. 10-24, Oct. 8, 15-**5**; weekly wages in Europe, *Am. Eng.* Mar. 25, Apr. 1, 8; food prices in Europe, Apr. 15-**6**.
" BALT. & OHIO R. employee's relief assoc. *Ry. Gaz.* Mar. 30-**3**; labor question and science, W. Siemens, *Electric.* Mar.-**7**; and wages in Am., Pidgeon, *Sci. Am. Sup.* Mar. 21; how to care for our poor fellow citizens, Cacheux, Sep. 19-**5**; riddle of sphinx, addr., Bayles, Apr. 10; Brotherhood of Locom. Engs., Arthur, May 15; 8 hour question, Atkinson, May 22-**6**; differences and arbitration, J. D. Weeks, *Soc. Arts*, Mar. 25-**6**.

LABOR, AMAL. SOC. OF ENGS. *Eng.* July 11; Iron Founders Soc. Aug. 15-**4**; industrial partnerships, Dec. 26-**4**; compar. value of, different countries, Jan. 2-**5**; employees socs. *The Eng.* May 11-**3**; in Europe, Feb. 12, 19; in Austria, Mar. 5, 12; employees socs., Stm. Eng. Makers Soc. Mar 5; wages, Europe, table, Mar. 12; do. May 14; do. Russian artels, or co-op. sys. Aug. 13-**6**; in Grt. Brit. Jan. 7-28, Feb. 4, 18, Mar. 4, 18, Apr. 1, 29, May 27, June 24, July 22-**7**.

LAKE, JAMES K., por. *St. Ry. Gaz.* Jan.-**6**.

LAND, division of, Paul, *Van Nost.* Aug.-**4**; U. S. govt. lands, disposal of, *Ry. Gaz.* Nov. 6-**5**.

" SLIP AT ZUG, Switz. *Sci. Am. Sup.* Nov. 12-**7**.

LANGUAGE, universal, Volapuk, n. *Eng. News*, Aug. 8-**5**; Vidal, Windstraud, *Sci. Am. Sup.* Nov. 28-**5**.

LATHES, eng., Lodge, *Iron Age*, Aug. 25; Shellenback pulley boring and turning, Dec. 29-**7**; spindle, Wohlenberg, *Mech.* Apr. 28; screw cutting dies, May 5; do. change gears, cals., Rose, June 2, 30; Rose Polytech. Inst., Ind. Oct.-**5**; do. *Am. Eng.* July 30-**5**; hollow, Mersey forge, Liverpool, Jan. 5-**7**; spindle "hold-fast," Faught, *Ry. Gaz.* Mar. 30-**3**; crank shaft lathe, Newburn, England, *Eng.* Aug. 3-**3**; recording indic., Simonds', Nov. 7-**4**; power and foot, Manchester exhib. Aug. 12-**7**; hollow, Mersey forge, Craven, eng. *The Eng.* Dec. 10-**6**. See also MACHINE TOOLS.

LAUNDRIES, Paris, *Eng. News*, Mar. 13-**6**; N. Y. *Sci. Am. Sup.* Dec. 26-**5**.

LAVOISIER, A. L., por. *Sci. Am. Sup.* July 23-**7**.

LAWN MOWERS, *Iron Age*, Mar. 27-**4**.

LEATHER, imitation, new plastic material, *Mech.* Apr. 7-**3**; tannin, sources, Trimble, *Fran. Inst.* June-**7**; chawing machs. *Sci. Am. Sup.* Jan. 20; dyeing, Beller, Oct. 6-**3**; manuf. and uses, E. J. Tanner, Sep. 10-**7**; dressing mach., F. A. Lockwood, inv. Aug. 7-**6**; do. *The Eng.* June 11-**6**.

LEEDS, England, industries of, *Iron Age*, Sep. 20-**3**.

LESSEPS, FERDINAND DE, por. *Sci. Am. Sup.* Sep. 1-**3**.

LIEBIG, por. *Sci. Am. Sup.* Mar. 3-**3**.

LIFE INSURANCE, testing econ. of expenses of management, *Sci. Am. Sup.* Sep. 20-**4**; do. Jan. 10-**5**; and mortality tables, Dec. 17-**7**.

" SAVING, service, U. S., Lyle, *Soc. Arts*, Jan. 24-**4**. See also MARINE, LIFE.

LIGHT, photometry, hist. *Iron Age*, Aug. 28-4; mechan. equiv. of, Apr. 8-6; photomet. measurements, sun, moon, elec., etc. *Van Nost.* Aug.-3; wave theory, *Fran. Inst.* Nov.-4; melting platinum standard of, expts., Cross, *Electric.* Nov.-6.

" ARTIF., Marks, *Elec. Rev.* Nov. 12-7; photom., hist. of, *Elec. World*, Aug. 2-4; and ether waves, E. R. Prescott, *Sci. Am. Sup.* Mar. 10-24; astigmatism and ophthalmometry, Gavarret, May 5; eye as an aid in photom. Oct. 31, Nov. 3-3; wave theory of, W. Thomson, Dec. 13-4; photometric standards, Apr. 11-5; vel. of, Newcomb's determin. Sep. 4; polarized, expts., Hopkins, Nov. 20-6; photom. for diffused, June 13-5; do. *Jour. Gas Lighting*; photom., hist. *Eng.* July 18-4. See also ELEC. LAMPS, LIGHTING; PHYSICS; SCIENCE.

LIGHT-HOUSE, Eddystone, Douglass, *Eng. News*, Apr. 19-4; foundation, 14 ft. bank, Del. bay, Oct, 31-5; lantern, Bishop's rock, Douglas, June 5-6; service, U. S. *Iron Age*, July 24-4; illuminants, expts. Oct. 8-5; illum., relative merits of elec., gas and oil, Feb. 18; deep sea, April 1-6; light-h's., U. S. *Mech.* July; do. iron, Dec.-4.

" EDDYSTONE, lantern, etc., Douglass, *Am. Eng.* Apr. 11-4; shifting, at Buddonness, Cunningham, Apr. 10-5; illuminants, *Van Nost.* Oct.-4; do. elec., gas and oil, Mar; do. expts., Edwards, June-6; elec., Isle of May, D. A. Stevenson, *Ry & Eng.* Oct.-7; illum., Gieseler, *Fran. Inst.* Jan.-7.

" EXPTS. n., *Electric.* June-5; illum., Hopkinson, Nov.-6; light-h's, Macquarie, Hopkinson, Apr; elec., of Tino, Oct.-7; light-h's, elec. *Elec. Rev.* Oct. 4-4; elec. light for, Heap, Sep. 19-5; elec. illum., rep., Millis, Feb. 6; elec. lighting, Mar. 27-6; light-h's, elec., illum. of, Hopkinson, *Elec. World*, Nov. 13, 20-6.

" MOUTH of Weser r. *Sci. Am. Sup.* Apr. 14-3; Eddystone, Douglass, Jan. 12; Mar. 22; Buddonness, removal of, Cunningham, Aug. 1-5; elec., on Isle of May, Stevenson, Oct. 8-7; do. *The Eng.* Aug. 19-7; light-h's and marine signals, *Eng.* Sep. 10-24-6; lamps, Wigham, Aug. 12; Rothersand, Dec. 2, 16, 16-7.

" EDDYSTONE, Douglass, *The Eng.* Dec. 7-3; Galley head, Sloane, eng. Jan. 11-4; Mew Is., Belfast, Douglass, eng. Jan. 9; lantern of 2nd order, and ap., Watling Is., Bahamas, Oct. 2-5.

LIGHT-HOUSE, lantern, Bishop's dock, Douglass, eng. *The Eng.* Apr. 16; Eddystone, model, Liverpool exhib. June 11; light-h's, light vessels, buoys and beacons, Douglass, Sep. 3; elec., of Macquairie and Tino, Dec. 24-6.

LIGHTING, chem. products of different kinds of, table, *Elec. World*, July 26-4; solid and liquid illum. agents, L. Field, *Sci. Am. Sup.* Sep. 22-3; artif., Crompton, Sep. 13-4. See also ELEC. LIGHTING.

LIGHT-SHIP, and ocean signal station, Cloudman's, *Elec. World*, Mar. 13-6; revolving lantern for, *The Eng.* Aug. 22, 22-4; lights, floating, Trinity H., steel masts for, May 6-7.

LIGHTNING, rods, Haskins, *Electric.* Aug.-4; protection against, McAdie, Aug.-5; conductor, Spang, *Elec. Rev.* Sep. 20, 27-3; conductor testing ap., Siemens', *Elec. World*, May 7-7; conductors, rep. *Sci. Am. Sup.* July 5; do. expts. Oct. 4; Slingo, Sep. 20; ball, Plante, Oct. 18-4; conductor testing ap. June 4; Dec. 24-7; rod resist. testing ap., Siemens', *The Eng.* Sep. 19-4.

LIGNEUR, manuf. ap. *Sci. Am. Sup.* Nov. 21-5.

LINCRUSTA WALTON, *Sci. Am. Sup.* June 2-3.

LINOLEUM, and floor cloth wks., Kirkaldy, *Eng.* Aug. 12-7.

LOCK, GILBERT, *Iron Age*, May 6-6.

LOCKS, Am. cabinet, *Iron Age*, Nov. 4-6.

LOCOMOTIVES. See RAILROAD LOCOMOTIVES.

LOGGING, on Columbia r. *Eng. News*, June 23, July 7-3; locom., Porter's geared, *The Eng.* Aug. 17-3.

LONDON, bridge travel in, n. *Eng. News*, Sep. 8; highways and travel, Dec. 1-3; bd. of wks. rep. May 30; growth, Aug. 15; size and extent, Sep. 12-5; pop. Feb. 13; munic. and san. eng. Aug. 28-6; pass. traffic, Sep. 10; buildings, cost per cu. ft., Isaacs, Oct. 1-7.

" FOG, cost of, *Iron Age*, Mar. 5-5; administration of a great city, Bazalgette, *San. Eng.* Jan. 31; smoke, money value of, Hoadley, Jan. 10-4; do. *Am. Machinist*; city pass. traffic, n. *Van Nost.* Oct.-4; fogs, cost of gas in, n. *Elec. Rev.* Dec. 24-7; earliest map of, *Sci. Am. Sup.* Nov. 10-3; growth of, Mar. 1-4; pop. *Eng.* Jan. 22-6; Met. Bd. of Wks. rep. *The Eng.* Mar 28-6.

LOOM, Keighley's, *Sci. Am. Sup.* July 28-3; handkerchief motion, May 3-4; open shed looms, May 23-5; carpet, Paris, May 14-7; Jacquard lacing mach., De Sparre, *Eng.* July 8-7.

LUBRICATING OILS, friction measurements, Woodbury, *Eng.* Dec. 5-4. See also ENG., MECHAN., FRICTION AND LUB; OILS AND LUBRICANTS.

LUMBER KILN, Casalonga, *Mech.* Aug.-6.

LYON, LEWIS, por. *St. Ry. Gaz.* Feb.-7.

MACHINE DESIGN, education of intuition in, J. T. Hawkins, *Iron Age*, June 30-7; do. do. *Mech.* sup. June-7; do. do. *Am. Eng.* June 1, 8-7; do. do. *Ry. Gaz.* Sep. 2-7; Jan. 19-3; O. Smith, *Mech.* Oct. 6-27, Dec. 29-3; do. Jan. 5, 19, 26, Dec.-4; do. Jan, Mar, June, Aug, Oct, Nov.-5; do. Apr, May-6; Galloupe, May-5; with regard to repairs, *Am. Eng.* Sep. 1, 8-6; Apr. 6, 20, 27, May 11-7.

" REPAIR WORK, *Mech.* Jan. 12; (patching), June 28, Sep.-4; Jan.-5; construction, *Am. Eng.* May 2, 9, June 6-4; surfaces, plane, error detecting in, Brashear, Jan. 23, 30-5; Sep. 1, 8-6.

" SHOP, one story, Dabney, *Iron Age*, Apr. 5; do. do. *Mech.* Mar. 31; arr., Fitch, Apr. 7-3; do. do. *Iron Age*, Apr. 12; Dickson Mfg. Co., Scranton, Pa., plan, Apr. 26-3; do. do. *Mech.* Apr. 21; oiling planer V's, Feb. 10; notes, Feb. 17 &c; wk., stock, dies and taps, Sep. 1; lathe wk. chucking, Rose, June 9, 16, Sep. 15; algebra, O. Smith, Nov. 17; planer tables, Dec. 22-3.

" SHOP practice, repair wk. *Mech.* Jan. 12; a college workshop, City of N. Y. May 17; repairing (patching), June 28, Sep; practice, milling tapers, Aug.-4; repairing, Jan.-5; turning large piston rod, etc. June-7.

" SHOP, time bk. *Am. Eng.* Apr. 15-6; gravity parallelometer, Brashear, July 20-7; accounts, Dec. 15-29-6; do. Metcalf sys. *Ry. Gaz.* June 4-6; blacksmith's art, ancient and modern, Newman, *Van Nost.* Feb.-5; do. *Bu. News*; critical methods of detecting errors in plane surfaces, Brashear, *Sci. Am. Sup.* Apr. 11; hand-craft and rede-craft, D. C. Gilman, July 11-5; decimal, binary and other scales, table, *Locom.* Sep.-3.

" TOOLS. See also LATHES; PLANING MACHS., ETC.

" TOOLS, Lancaster Co. *Iron Age*, Feb. 8; rachet brace, Schumacher, May 3-3; drill, twist, grinder, Feb. 7; wks., Lodge, Barker, Cincin. Oct. 16-4; heavy modern, July 22-6; lathe change wheels, *Mech.* Jan. 20-3.

MACHINE TOOLS, Lancaster Co. *Mech.* Feb. 3; Richards, Apr. 7, 28; May 19, 26, June 2, 16; chucking lathe wk., Rose, June 9, 16; stocks, dies and taps, Sep. 1; tool holders, Rose, Sep. 22; feeding, Oct. 13; lathe tools and wk. Nov. 3; templates, Nov. 17; files, drills and drilling, Rose, Nov. 17; lathe testing, do. Nov. 24; drilling and boring, do. Dec. 8; lathe recording aut. indic., Simonds, Dec. 22-**3**.

" TOOLS, turning and boring, Richards, *Mech.* Jan. 5, 12; do. tapers, Jan. 5; planing, Jan. 12; lathe, Jan. 19, 26; lathe chasers, Feb. 9, 16; boring, Rose, Feb. 9, 16, Mar. 1; microm. caliper, Frasse, Feb. 16; planers, Feb. 23, Mar. 22; uses, Mar. 8; drilling gauges, Mar. 15; nut wrenches, Mar. 29-**4**.

" TOOLS, boring tapers, *Mech.* Apr. 5; slotting, Apr. 12; Richards, Apr. 12; arr., Pemberton, Apr. 26; cutters, May 3, June 21, Sep; broaches for guns, May 10; milling, May 31, June 14; planer chucks, Thomas, June 28; feed motion, shaft straightener, July; Aug; wks., Lodge, Cincin., O. Oct.-**4**; measuring mach., Sweet, Feb; drill chuck, Mar; planer V's and chuck, Porter's, May-**5**; Feb, Mar, May, June-**6**.

" TOOLS, steels, quality, U. S. testing bd. rep. *Am. Eng.* Jan. 2, 9; drills, twist, Thorne, Nov. 19-**5**; elliptic hole cutting mach., Lyall, Apr. 22; heavy, Hulse, June 17; for heavy forgings and castings, do. Sep. 22, 29, Oct. 6-27, Nov. 3, 10; special, intrinsic value of, O. Smith, Dec. 22-**6**; Miles, *Ry. Gaz.* June 15; Sellers, Chic. exhib. Junc 22; do. do. Ry. appliances, July 30-**3**.

" TOOLS, metal cutting, W. F. Smith, *Sci. Am. Sup.* July 21-**3**; levelling mach. (for sheet metal), Britton, Nov. 7-**5**; Lyall's oval hole cutting mach. Aug. 7-**6**; electro-magnetic, Rowan, Sep. 3-**7**; annealing and tempering, fine, *Locom.* Oct.-**7**; do. *Sci. Am.*

" TOOLS, hydr. *Eng.* Mar. 9, 23, 30, Apr. 13, 27; for cutting metals, Mar. 2, May 4, 25; June 1; planing, Sep. 7, Nov. 9; eng. lathes, Nov. 30; drills, twist and grinders, Dec. 21-**3**; eng. lathes, Richards, Jan. 11; Mar. 7, May 16; lathe reversing gear, June 27-**4**; Inv's exhib. Sep. 4, Oct. 2-**5**; Hulse, *The Eng.* May 28-**6**.

MACHINERY, design, growth in, *Iron Age*, Mar. 25; plant, inventory value of, O. Smith, July 22; do. *Am. Eng.* June 17, 24-**6**.

MACHINERY, foundations, *Iron Age*, July 15-**6**; do. *Paper Trade Jour;* strains on, *Mech.* May 12; lub., Conly, June 23; age of, Sep. 1-**3**; strength of, May 17–31, June 7-**4**; complexity in, May-**5**; and appliances, rep. *Fran. Inst.* Apr.-**5**; balancing of, Seymour's ap. *Sci. Am. Sup.* Jan. 20-**3**; balancing rotating parts of, do. Sep. 19-**5**; and education, Raymond, Jan. 23-**6**; lub., econ. in, Conly, *Locom.* Aug.-**3**.

" RATING, *The Eng.* Feb. 15; theatrical, Madison Sq. theatre, N. Y. Feb. 29, Apr. 25; do. Paris Opera h. Feb. 29; at Health exhib. May 9–30, June 13, 27, July 4, Oct. 24-**4**; at Inv's exhib. July 3–31, Aug. 7–21, Sep. 25, Oct. 23, Nov. 6; Agric. Show, July 17; graphic kinematics of, R. H. Smith, July 31-**5**; at Liverpool exhib. July 2-**6**; hauling eng., Newcastle exhib. June 10-**7**.

MACHINES, topog. of, O. Smith, *Eng. News*, July 25-**5**; do. *Iron Age*, Oct. 9-**4**; invention of, July 1-**6**; iron and wood working, *Iron Age* files; cam construction, Jordan, *Mech.* Oct. 27-**3**; for physical tests, Abbott, *Mech.* Apr; topog. of, O. Smith, Oct.-**4**; evolution of, Shaw, *Van Nost.* Aug.-**5**; cams, rolling, construct., MacCord, *Sci. Am. Sup.* Oct. 3–10-**5**; invention of, H. Shaw, May 22-**6**; ancient toys, *Locom.* Aug.-**7**; topog. of, O. Smith, *Eng.* July 3-**5**; at Manchester exhib. Sep. 16-**7**; oscillation vs. rotation, Reynolds, *The Eng.* Jan. 5, 19, Feb. 2, 16-**3**.

MADAGASCAR, *Sci. Am. Sup.* Aug. 18-**3**.

MAGNETISM, *Eng.* June 15-**3**. See also ELECTRIC MAGNETISM.

MALT, mills, prevention of dust explosions in, *Fran. Inst.* Sep.-**3**; crushing mill, etc. *Sci. Am. Sup.* Sep. 15-**3**; manuf., Stopes, Mar. 13-**6**; malting, pneu. Apr. 19-**4**; do. do. at Troyes, *The Eng.* Jan. 25, 25; do. do. Galland's sys. June 20-**4**.

MAN. See MEN.

MANUFACTURES, methods and cost of, *Iron Age*, May 6-**6**; Am., table, *Elec. Rev.* Mar. 29-**3**.

MANUFACTURING, conditions of success in, *Iron Age*, Feb. 26-**5**; estabs., U. S., different states, Locom. July-**3**.

MAP REDUCTION, photographic, Harden, *Ry. & Eng.* May-**7**.

MARBLE QUARRIES, Vt. *Mech.* Sep. 15, 29-**3**.

MARINE ENGINEERING. Including NAVAL ENG. See also HARBOR ENG.

MARINE ENGINEERING, submarine explosions, Flood rock, N. Y. *Eng. News*, Oct. 17, 31-**5**; vessels speed, exception to Mansel's law, Magovern, *Mech.* Jan. 26-**4**; prog., Marshall, Oct.-**7**; explorations, *Sci. Am. Sup.* May 10-**4**.

" ENG., forced draft in large strs., n. *Eng.* July 31-**5**; fiction, Cruise of Meander, files Jan.-Dec.-**6**; and Clyde ship bu., '85, Jan. 15, 22; prog. July 30-**6**; curves of stabil., Heck, Apr. 8; Marshall, Aug. 5-**7**; bk. n., Seaton, *The Eng.* June 29-**3**; of future, Oct. 22-**6**; Am. Mar. 28-**4**; stm. practice, Am., table, July 17-**5**; do. *Mech. Eng.*

" ANCHOR, forging mach., Nock, *Iron Age*, Mar. 15-**3**; *Mech.* Feb. 24-**3**; gear, Baxter's, *Eng.* Sep. 5-**4**; do. do. Feb. 20-**5**; do. do. *Sci. Am. Sup.* May 2-**5**; Martin, July 30-**7**; do. do. Hawks, *Eng.* June 10; cast steel, committee rep. Dec. 30-**7**; gear, str. Algoma, *The Eng.* Feb. 19-**6**; stockless, Hall's cast steel, Oct. 7-**7**.

" ANGLE IRON bevelling mach. for ships frames, *The Eng.* Nov. 20-**5**.

" BLASTING, subaqueous, with nitroglycerine, *Iron Age*, July 16-**5**.

" BOATS. See also MARINE FIRE, LIFE, STEAM, TORPEDO, TUG BOATS.

" BOATS, submarine, Nordenfelt, *Eng. News*, Oct. 24-**5**; do. warfare, *Iron Age*, Nov. 6-**4**; do. Nordenfelt, Oct. 29-**5**; stm. launch, fastest, Herreshoff, July 22-**6**; launch engs., naphtha, June 30; submar., Nordenfelt, July 7-**7**; launch eng. with Davey b. *Mech.* Feb. 24; launch, elec., Yarrow, Aug. 25-**3**; do. fast, Pictet, Jan. 19; do. eng., comp., Duncan, June 21-**4**; propul. by galv. bats., Bechler, May-**7**.

" BOATS, submar., Nordenfelt, *Am. Eng.* Oct. 22, Nov. 5-**5**; stm. launch, Herreshoff's, July 28-**6**; gun boats, *Ry. & Eng.* Apr.-**7**; high speed, *Sci. Am. Sup.* July 21; do. Pictet's, May 19; submar. monitor, Sep. 1; launch, stern wheel, Stella, Dec. 22-**3**; catamaran, center bd. Dec. 27-**4**; do. stm., May Barrett, Jan. 17; launches and 56-ft. stm. cutters, Feb. 14; inclined plane sys. for, July 4; submar., Nordenfelt, Dec. 5-**5**; do. do. Apr. 23; do. Goubet's, Jan. 9; Trouve's elec. and siren, Sep. 11-**6**; petrol. eng., Lenoir's, Nov. 5-**7**.

" BOATS, stm. launch engs., comp. *Eng.* June 1; Chinese, Fisheries exhib. June 22-**3**.

MARINE BOATS, launch b., Burrell, *Eng.* Apr. 11; wrecking lighter, Thames Conservancy, Rennie, July 11; launches, trials, Aug. 22; pinnace, steamboat equip. of war vessels, Dec. 5; stm. cutters, 30 and 56-ft. do. Dec. 26-**4**.

" BOATS, stm. pinnace, 21-ft., eng. and b. for, *Eng.* Jan. 23; stm. launch, screw, light draft, Nile r., Thornycroft, Apr. 10; submar., Nordenfelt, Oct. 2, 16-**5**; stm. launch engs., comp., Burrell, Feb. 26; patrol, launching, Apr. 23; stm. launch eng. Oct. 15; submar., Nautilus, Dec. 24-**6**; submar. warfare (and mining) Bucknill, July 1-29, Aug. 5-26, Sep. 16, 30; launch, stm., Day, Oct. 7-**7**.

" BOATS, elec, *The Eng.* Apr. 4; do. b's, Tipping's, Sep. 26; stm. hopper barge, Beta, Nov. 7-**4**; do. eng. with Bremner's valve gear, Jan. 23-**5**; do. engs., comp., Butler's, July 16; do. engs., Parnell's, Oct. 1; submar. Dec. 3; launch eng., triple expan. high speed, French, Dec. 31-**6**; do. do. Jan. 7; submar., Nordenfelt, for Turkey, Feb. 11; fastest in world, Mar. 25; launch, elec., and motor, Elieson's, Oct. 14; do. stm., Buzz, Am. Nov. 4-**7**.

" BOILERS. See also MARINE ENGINES, STEAMERS.

" BOILERS, Cadiat's, *Mech.* Nov.-**5**; do. *Iron Age*, Nov. 19; zinc in, Dec. 10-**5**; feed water heating at sea, May 13; induced and forced draught, July 29; Dec. 2-**6**; high press. June 30; water tube, Thornycroft, Sep. 29-**7**.

" BOILERS, str. Rover, stm. making, C. A. Smith. *Am. Eng.* Jan. 4, 11; and combust. of fuel in furs., Howden, Apr. 25; str. Hunstanton, etc. Nov. 7-**4**; for propeller, Vanguard, Carroll, Pittsburg, Jan. 30; effic., Milton, May 1, 8-**5**; mineral oil combust. in, Jan. 7-21, Feb. 4. Mar. 25; plates, steel, failure of, Kent, Apr. 1-15-**6**; high stm. pressures at sea, July 13. 27-**7**; corrosion, Hallett, *Van Nost.* Dec.-**4**; high press. *Ry. & Eng.* Aug.-**7**; pressures, U. S. govt. rules for, *Locom.* Dec.-**7**.

" BOILERS, Bd. of Trade rules for, *Eng.* Mar. 23; str. Satellite, trials under forced draught, Mar. 16, 23; flues, corrug., strength of, Apr. 6; makers and iron ship builders, English, Aug. 24; strength, Nov. 9-**3**; corrosion, Sep. 5-**4**.

" BOILERS, water walls and fire-brick furs., str. Louisiana, *Eng.* Mar. 6; steel, thick plates, Parker, Apr. 3; forced draft, Robinson, Apr. 17; M'Kaig, Inv's exhib. Nov. 13-**5**.

MARINE BOILERS, fur., forced draft, *Eng.* Mar. 12, 19; closed stokeholds, str. Mersey, May 7; forced draft ap., str. Racilia, Oct. 8; evap. at sea, Nov. 5-**6**; high and low temp., Kemp, Stephen, Jan. 21-**7**.

" BOILERS, Livet's furnaces, *The Eng.* Jan. 12; for str. Claremont, July 20-**3**; str. Colossus, Feb. 8, 15; forced draft, Apr. 18; str. Oregon, Howden, Apr. 18; str. Knight of the Cross, Nov. 21-**4**; tug boat, Feb. 20; fur., forced draft, Willan's arr. Apr. 3; effic., Milton, Apr. 10; Cochran's, May 29; steel, str. Eastwood, June 19; forced combust., Harden's sys. July 10; zinc in, Phillips, Nov. 27; steel, strange failure of, Maginnis, Dec. 11-**5**.

" BOILERS, feed water heating at sea, *The Eng.* Apr. 16; forced combust. on str. Rodney, Apr. 23-**6**; fire-boxes, Thornycroft, June 17; str. Elbe and stm. pipe explosion, Dec. 23-**7**; do. *Eng.* Dec. 23-**7**.

" CABLES, SUBMARINE. See TELEGRAPH, OCEAN CABLES.

" COMMERCE protection, *The Eng.* Dec. 31-**6**.

" COMPASS, pole as a guide, *Van Nost.* Dec.-**3**; *Naut. Mag*; W. Thomson's, *Sci. Am Sup.* Feb. 6-**6**.

" CONSTRUCTIONS, concrete in, *Eng. News*, June 16-**3**; do. Dec. 11-**6**; do. *Iron Age*, Jan. 20-**7**; do. *Eng.* Jan. 12-**3**; do. July 4-**4**; do. Nov. 19-**6**; do. in sea water, Aug. 19-**7**. See also HARBOR ENG.

" DANGERS, avoidable, of ocean, Cottman, *Forum*, Nov.-**7**.

" DREDGER, twin-screw, str. Pholas, *Eng.* June 24-**7**. See also DREDGING MACH.

" ENGINES AND BOILERS, wt. as affected by stm. expansion, *Eng. News*, Oct. 30-**6**; of Lakes, Holloway, *Iron Age*, June 21; and ship construct., steel castings in, Parker, June 21, July 12, 19-**3**; condenser, surface, Wheeler, Jan. 7; triple expan., str. Enfield, Jan. 21, 21; for 40-knot ships, Sep. 2; of Etruria, Sep. 9-**6**; comp. Aug. 18; triple expan. Sep. 22-**7**.

" ENGS. and ship construct., castings in, Parker, *Mech.* June 9, 16; do. do. test tables, Aug. 4; of Lake strs., West. Trans. line, June 23; on Lakes (device for getting off centers), Holloway, June 30-**3**; and b's, Brit. ironclad str. Colossus, Maudslay, Mar. 15, Apr; crank shaft forging and pit turning mach. for, Apr. 12-**4**.

MARINE ENGINES, wks. and shipyard, des. for, Brown, *Mech.* June 7; comp., str. Normandie, July; condensers, Sep.-Nov; German str. Blitz, Oct.-**4**; triple expan., str. Australasian, Napier, Mar; do. Brit. str. Sobraleuse, Barrow, Aug; stm. and hydr. reversing, Allen, eng. Aug; str. Meteor, Goss Eng. wks. Oct.-**5**; triple expan., screw propeller, See, June; and comp. eng., limit of stm. press., Emery, sup. June; triple expan., Bechler, July; Marshall, Nov; indic. diags., Emery, Dec.-**7**.

" ENGS., ratios of expan., table, *Am. Eng.* July 25; des. Aug. 8; Sep. 5-**4**; shafts, comp. des., factors of safety, table, Feb. 6; str. Australasian, Feb. 27; crank shafts, strength, Mar. 20; triple comp., expts., Seaton, June 12; comp., for lake service, W. Miller, Dec. 31-**5**; comp. twin screw, strs. Surprise &c., English, Jan. 7; development of, Parker, Aug. 25; triple expan., Wyllie, Nov. 17, 24-**6**.

" ENGS., multiple comp., inertia, Meatyard, *Am. Eng.* Apr. 6; cyl. condensation and reduction by compounding, Emery, June 8; and comp. eng. and b. press. limits, do. June 15, 22; quadruple expan., Rankin, con. June 29; prog., Marshall, Aug. 17-31, Sep. 7, 14; triple expan., U. S. str. Sitka, Nov. 2; indic. diag., Emery, Dec. 7-**7**.

" ENGS., relations between size, speed and power of, Sennett, *Van Nost.* Sep.-**3**; triple expan., str. Aurora, Cleveland Ship Bu. Co. *Ry. & Eng.* June; do. coal consumpt. of, June; comp. and limit pressures, Emery, July; quadruple-expan., str. Myrtle, Rankin, Scotland, Aug; high press. and forced draft, trials, Sep; triple-expan. Oct.-**7**; crank pins, *Fran. Inst.* Mar; piston speeds, July-**3**.

" ENGS., str. La Normandie, *Sci. Am. Sup.* Sep. 15; str. Albatross, Oct. 27; propeller, MacCord, Dec. 15-**3**; b's, str. Churchill, Mar. 29; crank pin turning mach. May 3; comp., stm. yacht Lady Torfrida, July 12; war ship Rodney, Nov. 22-**4**; triple comp., Seaton, June 6; crank shaft imp. Nov. 21; condenser, surface, str. Calabria, Dec. 5-**5**; comp., and b's, str. Prometheus, May 8; cranks and shafts, J. F. Hall, June 19; crank shaft bu. Sep. 4; development, Parker, Oct. 16; do. Marshall, Nov. 26; triple-expan., Wyllie, Nov. 20-**6**; do. Henderson, Nov. 26-**7**.

" ENGS., and b's, paddle, Mawuna, *Eng.* Mar. 9; do. str. Hanoverian, Apr. 13; do. comp., str. Czar, Apr. 20, May 4-**3**.

MARINE ENGINES, comp. twin-screw, str. Satellite, *Eng.* May 25, Conqueror, June 29; comp., str. Tartar, Oct. 26, Nov. 9; b. and turning gear of strs. Nov. 30, Dec. 14-3.

" ENGS., and b., str. Churchill, Hall, *Eng.* Jan. 4; do. comp., str. Normandie, Barrow, Jan. 18, Feb. 1; do. str. Isle of Dursey, Wallsend Co. Feb. 29; twin-screw, str. Starthes, Apr. 25; do. comp., strs. Hunstanton &c. May 2-30; paddle, str. Samara, June 27; comp., Spanish gunboat Eulalia, July 4; and b's, twin-screw, triple-expan., str. Arabian, July 25; Ry ferries, Korsor, Aug. 22; German despatch vessel, Blitz, Aug. 29; crank material tests, Oct. 31; centrif. pumping, str. Umbria, Nov. 14; and b's, str. County of Salop, Dec. 5, 19-4.

" ENGS., wks., Hartlepool, *Eng.* Jan. 23; triple-expan., str. Australasian, Napier, Jan. 30; comp. twin-screw, Ital. torpedo ram str. Etna, Hawthorn, Feb. 6, 27; triple-expan., table, Feb. 13; and b's, comp., paddle str. Normandy, Mar. 20; comp., str. Cotentin, Wilson, Apr. 3; triple-expan., str. Sobraleuse, June 5, 19; coupling to shafts, Galloway, June 19-5.

" ENGS., stm. reversing, Allen, *Eng.* July 3; and gig, Simpson, Inv's exhib. July 17, and b., str. Meteor, Goss. Eng. wks., Bath, Me. Aug. 21; wks., Napier, Govan, Sep. 18; do. Clydebank, J. & G. Thomson, Sep. 18; and b's, comp., str. Boadicea, Rennie, Oct. 2; crankshaft, rep. Oct. 16; nom. H. P. of, Dec. 18; and b., comp., twin-screw str. Surprise, Palmer, Oct. 9, 23, Nov. 6, 20, Dec. 4, 18-5.

" ENGS., triple-expan., str. Enfield, *Eng.* Jan. 1; and b's, str. Royal Princess, Jan. 15; stm. yacht Lily, Jan. 22; friction, indic. diags., str. Cleveland, Feb. 26; and b's, paddle str. Kathleen Mavôurneen, Mar. 19; triple and quadruple expan. Apr. 2; str. Kronnag-na-mara, Apr. 9; flexible cranks and propeller shafting, Apr. 23; comp. and triple expan. Apr. 30-5.

" ENGS., and b's, str. Monas Queen, *Eng.* May 21, June 4; do. str. Royal Prince, June 25; str. Westmoreland, July 2; and b's, do. July 16; paddle str. Ozone, Aug. 20; comp., str. Stepney, Sep. 17, Oct. 1; triple expan. Nov. 5, 12; and b's, str. Nulli Secunda, Nov. 26-6.

MARINE ENGINES, triple-expan., str. Warrington, Westgarth, *Eng.* Jan. 7; and b's, triple-expan., stm. yacht Gladiator, Ramage, Feb. 4, 11; pneu. rotation indic., Rung, Feb. 11; triple-expan., stm. yacht Cassandra, Feb. 18; stm. tug Power, Usk Co. Feb. 25; and b's, quadruple-expan., str. Cty. of York, Barrow, Mar. 18, and b's, Apr. 1; wks., Central, West Hartlepool, Mudd, Mar. 25; triple-expan., str. Maryland, Apr. 8; 4-cyl. quad.-expan., stm. yacht Myrtle, Rankin, June 10; piston valves, June 24; quad.-expan., Brock, Nov. 4; triple-expan., str. Bencroy, Dec. 30-7.

" ENGS., comp., str. Leerdam, *The Eng.* Jan. 5; comp. surface condensing 20 H. P., screw yachts, Venus, sup. Jan. 12; triple-expan., str. Millicent, Feb. 2; grasshopper, tug-boat Henrietta, Apr. 27; comp. yacht, Shank's, July 27; and b's, U. S. strs. Boston, Atlanta and Dolphin, Nov. 2, 9; for light draft strs. on Siberian rivers, Nov. 9-3.

" ENGS., old, *The Eng.* Jan. 18; and b's, str. Colossus, Feb. 8, 15; 3-cyl. comp., Willans, Apr. 4; cable ship Monarch, Apr. 25, May 2, 2; H. P. of, May 23; and b's, torpedo boat for Russian govt. June 6-27, b's, July 4, fan, July 18; comp. armored turret ship Riachuelo, Brazil, July 4, 4; crank shaft, making, N. W. Wheeler, Aug. 22; do. strength, Oct. 24; comp., str. Henry Wright, Oct. 31; and b., comp., for Japan, Nov. 28; Brit. twin screw str. Amphion, sup. Dec. 19-4.

" ENGS., comp., tug-boat Hibernia, *The Eng.* Jan. 30, 30; diagonal surface condens. paddle wheel, Shanks, Feb. 20; twin screw tug-boat America, Apr. 3; comp., str. Mona, Apr. 10; surface condenser, Kirkaldy's, June 5; condensing water, cost of, June 12; triple-expan. June 26-5.

" ENGS., triple-expan., str. Eastwood, Earle, bu. *The Eng.* July 3, 3; do. with Joy valve gear, July 24, 24; comp., for Seine r. pass. boats, Aug 14, 14; and b's, trial, str. Prince Albert, table, Sep. 25; 15 H. P. launch and yacht, comp. surface condens. Oct. 2; and b's, French war vessel Phlegeton, Oct. 9, 16, 16, pumping mach. Oct.23; surface condensation, str. Calabria, Kirkaldy, Oct. 30; triple-expan. Oct. 30; twin screw, str. Scout, Dec. 18-5.

" ENGS., and b's, U. S. twin screw str. Chicago, *The Eng.* Jan. 29, 29; comp. paddle, Indian govt. Feb. 12; pumping, Mumford, eng. Mar. 5-6.

MARINE ENGINES, and b., comp., str. Prometheus, *The Eng.* Mar. 5; triple-expan., and crank shaft, str. Coot, Apr. 16; comp., converting into triple-expan., Cole, Apr. 30; high speed, July 9; and b., triple-expan., str. Matabele, Hall, Aug. 6; do. Wyllie, Nov. 5, 5; do. French high speed launch, Dec. 31-**6**.

" ENGS., str. Poplar, *The Eng.* Feb. 4; triple-expan., Morison, Feb. 11; do. vs. comp. Apr. 15; do. str. Oroya, Barrow, May 6; and b., comp., str. Mananeuse, Rollo, May 20; do. for Atlantic strs. June 3, 10; triple-expan., str. Worcester, July 29; do. str. Dogali, Aug. 5, 5; comp., high speed launch, Aug. 12; do. triple-expan. Aug. 26; side wheel ferry str. Edinburgh, Sep. 23; triple-expan., str. Benbow, Oct. 14; do. German mail strs. Dec. 2; and b's, do. do. Dec. 23-**7**.

" EXPLORATIONS, submarine, *Sci. Am. Sup.* May 10-**4**.

" EXPLOSIVE, nitro-gelatine, *Iron Age*, Aug. 27-**5**. See also EXPLOSIVES.

" FERRY, stm., Isle of Wight, England, Mason, *Mech.* Nov.-**5**; do. *Eng.* Aug. 7-**5**; Ry. ferry boats, Korsor, Aug. 8-**4**; strs., Flannery, eng. *The Eng.* Oct. 5-**3**; boats, Snowdrop, Flannery, des. May 1-**5**; do. No. and So. Woolwick, Dec. 24-**6**; sidewheelstr. Duchess, Edinb. Aug. 12, 19, Sep. 23, sup. 23-**7**.

" FIRE BOATS, Brooklyn, *Eng.* Jan. 7; for Cleveland and Chicago, Cowles, Jan. 14-**7**.

" FISHING, vessels, English and Am. *Eng.* Jan. 11-**4**; boat, stm., Cran, Jan. 29-**6**; do. capstan and trawling mach. *The Eng.* June 15-**3**.

" FOG SIGNALLING, mach, Craig, *Sci. Am. Sup.* Sep. 25-**6**; *Eng.* Mar. 23-**3**.

" GOVERNORS, elec. *Mech.* May-**5**; do. *The Eng*; n. Apr. 24-**5**; Oct. 22-**6**; Murdoch, Cochrane, *Eng.* Feb. 4-**7**.

" GRAIN CARGOES, Jenkins, *Eng.* Apr. 22-**7**.

" GUNNERY, *Eng.* Apr. 20, 27-**3**. See also GUNNERY AND ARMOR.

" HAULING AND PUMPING MACH., for slipways, *Eng.* July 9-**6**.

" HYDRAULIC, mach. *Eng.* Apr. 18, 25-**4**; do. str. Quetta, *The Eng.* Apr. 11, 18-**4**; propulsion, stm. boat, *Am. Eng.* Apr. 24-**5**; do. str., by reaction, *Sci. Am. Sup.* Dec. 15-**3**; do. of ships, May 16-**5**; do. of vessels by jet propellers, Oct. 2-**6**; do. *Eng.* Feb. 29-**4**; do. Barnaby, *The Eng.* Mar. 21-**4**.

MARINE ICE BREAKER, str. Bryderen, Sweden, *Eng.* Feb. 6-**5**.

" LIFE, boats, Brit. *Sci. Am. Sup.* July 17; do. stm. July 17-**6**; do. do. Apr. 2; saving rocket service, Feb. 5; raft, Copeman, May 28-**7**; saving service, Lyle, *Soc. Arts*, Jan. 24-**4**; ap. on ships, *Eng.* June 3-**7**; boat, stm., Benjamin, *The Eng.* Apr. 30; do. Liverpool exhib. Jan. 11-**6**; do. stm. tubular, Beloe, des. Jan. 28-**7**.

" LIGHTSHIPS across the Atlantic, proposed, *Mech.* July-**5**.

" LLOYDS, *The Eng.* Oct. 31-**4**.

" MESSAGERIES, MARITIMES, French, *Eng.* Aug. 22-**4**; July 1-**7**.

" NAVAL ARCHITECTS, Inst. pro. *Am. Eng.* Apr. 25, May 2, 9-**4**; *Sci. Am. Sup.* June 26-**6**; *Eng.* Mar. 23, 30-**3**; Apr. 4-25-**4**; Apr. 3-17-**5**; Apr. 16-30, May 7, July 30, Aug. 6, 13-**6**; Apr. 1-15, July 29, Aug. 5, 12-**7**; *The Eng.* Mar. 16-30, Apr. 6-**3**; Apr. 4-18-**4**; Mar. 27, Apr. 3-**5**; Apr. 16-30-**6**; Apr. 1-15-**7**.

" NAVAL, architecture, study of, Elgar, *Van Nost.* Mar.-**5**; review, England, *Ry & Eng.* Sep.-**7**; training, Elgar, *Sci. Am. Sup.* Nov. 15-**4**; at Inv's exhib. Sep. 5; mild steel applied to, and military purposes, Mackinlay, Sep. 5-**5**; 50 years prog. Apr. 16-**7**; attack, *Eng.* Mar. 21-**4**; architecture, Inv's exhib. Sep. 11-**5**; Annual, English, Dec. 17-**6**; Admiralty coeffs., Mansel, *The Eng.* May 21, June 18, Sep. 3, Oct. 1-**6**; do. do. Dec. 23-**7**.

" NAVIES, navy yards, European, rep. *Eng. News*, Nov. 7-**5**; commercial, of world, *Iron Age*, July 31-**4**; of Europe, Nov. 12-**5**; navy, cruisers, U. S. Dec. 2; do. dept. wk. of, U. S. Dec. 9-**6**; merchant navy of world, stat. Sep. 1-**7**; of Europe, Hichborn, *Mech.* Dec.-**5**; Chinese navy, *Ry & Eng.* Oct; U. S. war ships, Oct, Nov; navy dept., U. S. Dec.-**7**; naval battle of Trafalgar, *Sci. Am. Sup.* Dec. 5-**5**; the ram in naval warfare, *Eng.* Feb. 29; Brit. navy, Dec. 5-**4**; do. Mar. 19, 26-**6**; Brit. and French ironclad, *The Eng.* Sep. 12; do. unarmoured, Oct. 17; navy imp. Nov. 28, Dec. 5-**4**; of world, tables, Aug. 13, 27, Sep. 3; of Britain and France, Oct. 29-**6**; French, armor for, table, Dec. 31-**6**.

" NAVIGATING under water, *Iron Age*, Apr. 22-**6**.

" NAVIGATION, inland, abroad, Tapscott, *Eng. News*, Apr. 4-**5**; do. European, Feb. 6-**6**; capstan, on Volga r. *Am. Eng.* Feb. 27; inland, of Europe, June 5-**5**; hist. of, *Sci. Am. Sup.* Nov. 10-**3**.

MARINE NAVIGATION, inland, in Europe, hydro-mechanics, Hartley, *Sci. Am. Sup.* May 30; chart for great circle sailing, R. A. Proctor, Aug. 8-**5**; stm., early expts. May 14-**7**; inland, in Ireland, *The Eng.* Jan. 26-**3**; do. in Europe, Hartley, May 29-**5**; Panhellenic stm., Greece, Mar. 12; do. on continent, July 9-**6**.

" OCEANS, of world, *Eng. News*, Oct. 25-**4**; sea, depths of, *Iron Age*, Apr. 5-**3**; water temp. at various depths, *Mech.* May 3-**4**; sea horizon, Jan.-**5**; ocean travel, limit of speed in, *Am. Eng.* June 10-**6**; do. and air currents, Smellie, *Sci. Am. Sup.* Oct. 3; water, composition of, Dittmar, Nov. 28-**5**; geology of the Atlantic, Oct. 30-**6**. See also MARINE SEA, WAVES.

" PENINSULAR & ORIENTAL CO. *Eng. News*, June 26-**6**.

" PROPELLERS, guide blade, Thornycroft, *Mech.* June 2-**3**; water jet, *Van Nost.* Jan.-**3**; reaction, accident, *Sci. Am. Sup.* Aug. 27-**7**; jet, Atkin's, *Power & Trans.* Sep.-Nov.-**6**; *Eng.* Apr. 16-**6**; guide blade, effic., Thornycroft, *The Eng.* Mar. 16-**3**; jet, Aug. 27-**6**. See also MARINE, HYDR. PROPUL., SCREW PROPELLERS.

" PROPULSION of ships, jet, *Iron Age*, Apr. 1-**6**; do. *Am. Eng.* Mar. 4-**6**; Oram sys. *Fran. Inst.* June-**6**.

" ROUTES, N. Y. to London, Milford Haven route, *Ry. Gaz.* Sep. 30-**7**; Hudson Strait and Bay, *Eng.* June 17-**7**.

" SCREW PROPELLERS, *Am. Eng.* July 7-**6**; Atkins, *Power & Trans.* Jan.-Apr.-**7**; steering gear, Thompson, *Eng.* Sep. 17-**6**; effic., Froude, *The Eng.* Mar. 23-**3**; do. Greenhill, June 4, 25, July 9, Sep. 17-**6**; do. do. Feb. 25, Mar 18; do. Blechynden, July 1-**7**.

" SEA, deep sounding and dredging, *Mech.* Dec. 29-**3**; do. Jan. 5-**4**; do. *Van Nost.* Jan.-**3**; do. str., G. S. Blake's ap. *Sci. Am. Sup.* Aug. 18-**3**; explorations in Gulf stream, Verrill, Nov. 1-**4**; soundings and ap., Bartlett, *Soc. Arts*, Oct. 26-**2**; do. Sigsbee's, *Eng.* Oct. 2; and dredging, Sep. 28-**3**.

" SEA-WATER, making potable, *Eng. News*, June 27-**5**; evap. ap. in vacuo, Jones, *Iron Age*, Feb. 24-**7**; condensing ap., Provand, *Mech.* June 21-**4**; distilling ap., Normandy's, *Sci. Am. Sup.* Aug. 25; do. from fresh, Harding, Oct. 6-**3**; properties and constitution of, Saporta, Mar. 14; distil. of, (mil. uses), June 6; making potable, Kay, June 11-**5**.

MARINE, SEA-WATER, condenser, distilling, ap., do. *Eng.* May 30-**4**; friction still for, Pearce's, *The Eng.* Dec. 4-**5**; evap. ap. in vacuo, C. Jones, Oct. 15-**6**.

" SCREW, steering ap., Kunstadter, *Iron Age*, Aug. 6-**5**; do. *Mech.* Aug; screws, twin, Maclaine, Nov.-**5**; propellers, *Fran. Inst.* Sep.-**3**; do. Aug.-**6**; do. Pistoja, *Sci. Am. Sup.* Feb. 3-**3**; do. maganese-bronze, *Eng.* Oct. 19-**3**; do. blades, strains on, Calvert, Apr. 8; do. Blechynder, May 13, June 3, 10-**7**; twin, Maclaine's, *The Eng.* Apr. 24-**5**.

" SHIPS, including war ships. See also MARINE STEAMERS.

" SHIP bu., '82, English, *Iron Age*, May 10; do. iron and steel, on Delaware r. Sep. 20; shipping, Am., decline of, Dec. 13; steel, for navy, Dec. 13-**3**; Am. Feb. 7; bu., iron, in Cal. Feb. 28; do. Am. Co.'s wks. Mar. 27; do. Sweden and Norway, Aug. 7; do. iron, and hist. Nov. 27; do. on Delaware r. Dec. 4; do. 150-ton shears, Am. Co., at Phil. Dec. 18-**4**.

" SHIP bu., iron, *Iron Age*, Feb. 5; merchant, of all nations, Aug. 13; steel vs. iron Nov. 12; merchant marine, the world's, '85, Nov. 12-**5**; bu., English, in '85, Jan. 28; 40-knot ships, June 17; new war, Aug. 12; armor, rubber and asbestos for, Sep. 23; Brit. war, Benbow, Oct. 14; iron and steel, durability of, Oct. 14-**6**.

" SHIPS, Brit. war, *Iron Age*, Feb. 10; raising sunken, July 28; at sea, telephonic connection between, L. J. Blake, Nov. 10-**7**; shipping of world, *Mech.* Jan 13; rudder, solid cast steel, Jessop, Mar. 17; bulkheads in, Apr. 28; bu., iron and steel, Delaware r. Oct. 6; resistance of, Dec. 8-**3**; Am. Feb. 2; gun shields for cruisers, Clark, Feb. 9-23, Mar. 1, 8; bu. shears, Am., Phil. Dec.-**4**; steel vs. iron, Boyd, Dec-**5**; war, non-sinkable, Bechler, June-**7**.

" SHIPS, vessel loading, Murgatroyd's sys. *Am. Eng.* Feb. 8; bu. imps., Wm. John, July 4-**4**; do. Biles, Oct. 1; Brit. war, Scout, Oct. 15-**5**; shipping, Am., decline of, Jan. 14; bu., mild steel for, Martell, May 20, 27, June 3-**6**; do. steel as used for, Sep. 14, 21-**7**; hos., plan, *San. Eng.* Mar. 5-**5**; bu. on lakes, table, *Ry. Gaz.* Dec. 2-**7**.

" SHIPS, load lines of, *Van Nost.* Sep; do. *Naut. Mag;* iron, deviation in compasses, Creak, *Van Nost.* Sep.-**3**; do. vessels construction, Sep.-**4**; bu., mild steel for, Ward, June; steel, Sep; corrosion of copper of Juniata, Munroe, Sep.-**6**.

MARINE SHIPS, Brit. war, *Ry. & Eng.* Feb; do. do. W. H. White, Mar, Apr; do. Reina Regente, Spain, May; Brit. May; bu., lake, U. S. May; steel castings, July; U. S. war, Newark, 4 & 5, July; armored battle, Aug, Sep; English war, Trafalgar, Oct; merchantile shipping of world, Oct; at sea, telephonic communication between, Blake, Oct.-**7**; do. do. *Elec. World*, Aug. 27-**7**; gun shields and water line defense for cruisers, *Fran. Inst.* Jan, Feb.-**4**.

" SHIPS, logs, elec. *Set. Am. Sup.* Jan. 6; stability indic. May 19-**3**; Brit. Feb. 2; models, speed expts. with, Apr. 12; U. S. war, Atlanta, Dolphin and Chicago, Hayes, Apr. 12, 12; Teredo and his work (ship worm), Sep. 6; Castalia hos. Dec. 20-**4**; steamboat equip. of war vessels, Apr. 11; water chambers for reducing rolling at sea, May 16; merchant vessels as armed cruisers, June 27; German men of war, July 4; launching and docking of, sidewise, July 11; Brit. war, expt. evolutions with, Aug. 15-**5**.

" SHIPS, magnetism, Bottomley, *Sci. Am. Sup.* Mar. 27; buffer, hydr. collision, Stanley's, May 1; steel castings for, E. C. Warren, July 10, 17-**6**; gyroscope collimator, Fleuriar's (ship oscils.), Feb. 26; war, W. H. White, Mar. 5; French war, Neptune, July 23; at Queen's jubilee review, Sep. 3; rudder action, Frith, Sep. 3; of war, old English, Sep. 10-**7**; rigs of vessels, Forbes, *Soc. Arts*, Dec. 13-**3**.

" SHIP bu. and marine eng., Clyde, '82, *Eng.* Jan. 12, 19, Feb. 2, 23-**3**; do. '83, Jan. 25, Mar. 7-**4**; slipways, Feb. 23; turret with chilled cast iron armor, June 8; chilled cast iron ar. June 15; proportions of vessels, Aug. 31-**3**; Brazil turret, Riachuelo, Apr. 4; vessels stability, Apr. 11, May 2, Oct. 17; eng. do. Apr. 18; jury rudder, str. Knickerbocker, Aug. 1; ar., chilled cast iron, expts. Oct. 17; shipping, Lloyd's register, Oct. 31; hos., Castalia, Oct. 31-**4**.

" SHIP bu. and eng., Clyde, '84, *Eng.* Jan. 30, Feb. 6; do. trade, English, Feb. 20; stability of vessels, Heck, Apr. 10; winch and windlass, Illaroo, June 12; man-of-war and Capt's duties, Aug. 14; shipyard, Leven, Sep. 4; do. Fairfield wks., Govan, Elder, Sep. 11; bu. notes, Biles, Sep. 11; rudder, temporary, Lucas, Oct. 2; teleg. indic., Lloyd, Oct. 2; war, requirement, Nov. 6; shipping, French ports, n. Dec. 25-**5**.

" SHIPS, Cruise of Meander (fiction), *Eng.* Jan.-Dec; still water friction, Pearce, Jan. 8-**6**.

MARINE SHIPS, jury rudder fitted to str. Gloucester, *Eng.* Feb. 5; bu., Brit. future, Mar. 12; armor plated turrets, expts. Mar. 19; guns, Hotchkiss and Nordenfelt, Mar. 19; war, Mar. 26; strain indic. Apr. 30; English vessels register, May 28; hydr. mach. for cleaning bottoms, June 25; boat housing, Wilson, Aug. 6; pump, Joicey, Aug. 20; framing, Thompson's sys. Nov. 19; stability cals. for, Dec. 10-6.

" SHIPS, bu. and eng., Clyde, '86, *Eng.* Jan. 7, 14, Feb. 4; war, Jan. 28; do. fuel supply, Barnaby, Apr. 8; cruiser armor, belted and internal, Biles, Apr. 15; life-saving ap. on, June 3; bu., basic steel for, Martell, July 29; Bu. & Iron Co., Palmer, July 29; do. diagrams, Grt. Brit. Sep 2; water tight door, M'Elroy, Nov. 11-7.

" SHIP bu., Brit. in '82, *The Eng.* Jan. 12, n. 19; stern frames and rudders, cruc. cast steel, Jan. 19; stability indic. for, Taylor's, Mar. 9; rolling reducing at sea, P. Watts, Apr. 6; hogging strains, Smith, Apr. 6; Reed's ironclad, June 1, 8; Daphne disaster, Aug. 24; Kingston trawl winch, Sep. 21; stability at launching, Biles, Nov. 16-3.

" SHIPS, models, speed expts. with, *The Eng.* Feb. 15; cradle, Ayr har. Feb. 22, Mar. 28; armor clad turret, Riachuelo, Samuda, Apr. 4, 11; ventil., Webb sys. Apr. 18; iron and steel, imps., John, May 16; launching sideways, N. W. Wheeler, June 20; stm. trawling cruise, July 4; ventil. ap., Green's, Oct. 3; bu., Elgar, Nov. 14-4.

" SHIPS of war, armor distrib. in, *The Eng.* Aug. 7-5; stability, Feb. 19; bu., Brit. in '85, Feb. 19; turret trial at Bucharest, Mar. 5, Apr. 16; war, speed trials of, W. H. White, Apr. 16; 40-knot speed, n. May 7, n. June 18, July 2; iron, inventor of the, addr., Bailey, Nov. 12; iron and steel, butt connections of, Dec. 24; vessels, list, Dec. 24-6; disappearing turret, Mongin, Feb. 11; Brit. merchant service and royal navy, Barnaby, Apr. 1; tonnage, Dec. 30-7.

" SIGNALS, submarine, J. M. Batchelder, *Soc. Arts*, May 26-7.

" STEAMBOATS, boating chronol. *Eng. News*, Jan. 24-5; shafts, H. W. Baker, *Am. Eng.* June 12, 26-5; Norwich, Grt. East. Ry. *The Eng.* Jan. 23; Am., Rigg, Mar. 6; stern wheel, for Brazil, May 8-5. See also MARINE STEAMERS.

" STEAMERS, U. S. twin screw steel cruiser, *Eng. News*, Sep. 4-6.

MARINE STEAMERS, U. S., old stm. vessels, *Iron Age*, Mar. 29; ocean speeds, June 7-3; steamships, revolution in, June 19; Brazil's war-ship, July 31; Chilian cruiser, Esmerelda, Nov. 13; speed of, Dec. 4-4.

" STRS., chronol. *Iron Age*, Feb. 19; 1st to cross ocean, Feb. 26; fast cruiser, Mar. 5; crank shafts, strength, Mar. 5; iron, life of, Apr. 9; U. S. rep. on Dolphin, June 25; English, Benbow and armament, July 23; U. S. naval cruisers, Oct. 15; iron clad war, in So. Am. Oct. 15; fast ocean, Dec. 10-5.

" STRS., Great Eastern, *Iron Age*, Aug. 12, 26; Atlantic, Sep. 9; costs of fast do. Sep. 9; fast ocean, Sep. 16; steel, lake, Susquehanna, Sep. 30; Russian cruisers, Nov. 25; U. S. navy do. Dec. 2-6; coal consumpt. cal., table, Jan. 20; ocean, size of, Mar. 24; boat, fastest in world, Ital. govt., Yarrow, Apr. 14; Great Eastern, May 5; N. Y. Atlantic liners, speed of, Dec. 29-7.

" STRS., City of Fall River, Old Col. R. *Mech.* Mar. 17; stm. vessels, old U. S. Apr. 7; twin screw, Victoria, Pusey, May 19; ocean speeds, June 16; Oregon, Guion line, Aug. 4, Oct. 27; steamships effic., Magovern, Aug. 4; broken shaft coupling, A. Thomson, Dec. 22-3; U. S., Albatross, Feb. 23; mach. repairs, Hamilton, Aug; Brazilian armored iron clad, Riachuelo, Sep.-4; coal consumpt. n. Jan, Apr; 1st to cross ocean, Mar; Normandy, feathering paddle wheels, Elder, June; U. S., Dolphin, defects of, Isherwood, July; U. S. cruisers, Naval Bd. on, Nov.-5.

" STEAMERS, rev., for U. S. of Colombia, *Am. Eng.* Jan. 4; Assyrian Monarch, Jan. 18; designing, Pearsons, Mar. 7, 14-4; Brit. cruiser, Feb. 13; tin clads for Nile r. Mar. 6; Guion line, fuel consumpt. Apr. 10-5; crank shafts, See, May 27; ocean travel, limit of speed in, June 10-6.

" STEAMSHIP econ. *Am. Eng.* July 14; transportation prob. (vessels), Am. Juiy 21, Aug. 18; Orlando, Aug. 25; triple comp. lake, Sep. 15; ocean transport. by petroleum, Dec. 29-6; dynamite cruiser, Apr. 13-7; Cunard, Umbria, *San. Eng.* Dec. 11-4; cruisers, swift, *Van Nost.* May-5; ocean travel, limit of speed in, Cazin, Sep; do. do. Thurston, July-6; do. do. *Forum.*

" STEAMERS, English, Narcissus, *Ry. & Eng.* Feb; ocean, sizes of, Mar; U. S. naval, Apr; do. war ships, Oct, Nov; do. navy dept. Dec; Reina Regente, Spain, Dec.-7.

MARINE STEAMERS, Atlantic, what speed costs in, *Ry. Gaz.* Sep. 17-6; speed of modern, Aug. 5-7; City of Fall River, trial of, *Fran. Inst.* July–Sep.-4; Sound, Pilgrim, Roach, *Elec. Rev.* Mar. 29-3; great Atlantic, fast, Oct. 4-4; U. S. cruisers, elec. light for, Murdock, Aug. 20-7.

" STEAMERS, La Normandie, *Sci. Am. Sup.* Jan. 6; moving of large masses, Jan. 13; La Plata, cruc. cast steel rudder, Mar. 10; rig, Forbes', Apr. 28; Violet, Lond. & No. West Ry. Co. May 26; ocean, swift, June 16; twin-screw shallow draft, Thornycroft, July 21; Swiss lake, July 28; light draft stern wheel, Aug. 18; U. S., Albatross, Oct. 27-3.

" STEAMERS, French, Talisman, *Sci. Am. Sup.* Apr. 19; ash hoisting ap. May 3; Brazil, Riachnelo, Samuda, May 24; vibration of stm. vessels, Schlick, May 31; French iron clads, L'indomptable, June 21; 4-ton guns, Chilian, Esmerelda, Dec. 20-4.

" STEAMERS, great Atlan., dimens. and power, table, *Sci. Am. Sup.* Feb. 14; Brit. twin-screw war, Colossus, May 16; shallow draft propeller and fast screw launch, May 23; Coppin's triple steamship, July 18; mail, Ireland, Oct. 24; Brit. war, Imperieuse, trial trip, Nov. 21-5; Brit. Camperdown, Feb. 20; Collingwood, accident on, June 12; Grt. Eastern, June 12; Japanese iron clad, Nanina, June 26-6.

" STEAMERS, steel stern wheel, *Sci. Am. Sup.* July 31; new Am. war, U. S. twin-screw cruiser, 4,000-tons, &c. Aug. 21; Peer of Realm, raising wreck, Sep. 4; Brit. war, Orlando, Sep. 11; express Atlan. Sep. 11; screw shaft ball thrust bearing, Sep. 25; Atlantic, W. John, Oct. 2; fastest seaboat, Chinese, Oct. 16; channel, Victoria, Oct. 30; French war, Le Hoche, Nov. 20; Brit. war, twin-screw barbette, Benbow, Dec. 11; salvage of Oregon's cargo, Merritt, Dec. 18-6.

" STEAMERS, Nulli Secunda, *Sci. Am. Sup.* Jan. 1; transatlantic, risks of, Jan. 22; French gunboat, Gab. Charmes, Jan. 29; Grt. Eastern, Mar. 12, June 18; disappearing turrets, Mar. 19; Spanish war, Pelayo, Apr. 2; liquid fuel on, Apr. 2; light draft twin-screw, for Nicaragua, Apr. 9; do. river, May 14; dynamite cruiser, May 14; German corvette, Greif, June 18; high speed twin-screws, Linnington, June 18; Brit., Sanspareil, June 25-7.

" STEAMERS, ocean, stat., table, *Sci. Am. Sup.* Aug. 13; flex. crank and propeller shafting, Oct. 22-7.

MARINE STEAMERS, shallow draft stern wheel, for Magdalena r. *Sci. Am. Sup.* Nov. 12; Fifeshire, refrig. mach. Dec. 3-7; first applic. of stm. for propelling vessels, inventor of, *Locom.* June-3; speed of European war vessels, Sep.-6. See also MARINE TORPEDO BOATS.

" STEAMERS, strains on, *Eng.* Apr. 6; Castle Packet line, Hawarden Castle, Apr. 13; twin screw shallow draft, for Congo r. May 18; masting, ships of war, May 18; do, June 1; Oregon, June 29; U. S. govt. Fish Commiss., Albatross, Sep. 7-3; do. do. engs. and tests, Oct. 17; steamships, speed-trials, Dec. 26-4.

" STEAMERS, war vessels, steamboat equip. of, *Eng.* Jan. 16, 23; paddle wheel, hist., Sandham, Apr. 3, 17, 24, May 22; stern wheel, Volga r., R. Runeberg, Apr. 10; cruisers and turretted battle ships, Apr. 17; triple steamship, Coppin, May 22; French stm. shipping, Messageries Maritimes, June 26; Brazil govt. stern wheel, Forrest, Aug. 28-5.

" STEAMERS, paddle wheel, Kathleen Mavourneen, *Eng.* Mar. 5; English, forced combust. in, Mar. 12, May 7, 21, 28; war ships, speed trials, Apr. 16; paddle, Mona Queen, Isle of Man, May 7; Nanina, Japan, May 14; raising Peer of Realm, May 21; Etruria, Aug. 13; stern wheel river, Aug. 20; Atlan., speeds, Aug. 20, 27; Am. cruiser, Sep. 3; forced draft on, Oct. 8; U. S. cruisers, Oct. 8; Orizaba, Oct. 8, Dec. 17; Benbow, Oct. 22; Pac. Stm. Nav. Co.'s, Nov. 12, Dec. 17; Nulli Secunda, Nov. 12, 26; Narcissus, Dec. 17-6.

" STEAMERS, twin-screw, Reina Regente, J. & G. Thomson, *Eng.* Mar. 4; Spanish iron-clad, Palayo, June 3; raising of Locksley Hall, Aug. 19; English, Trafalgar, Sep. 23; The Earl, and b's, French, and salvage and tug-boat, Oct. 14; Spanish cruiser, Reina Regente, Oct. 21; Britannia, Peninsular and Oriental, Oct. 28; English, Orlando, Palmer, Nov. 4; engs. and b's, Nov. 25; Electra, Russell, Dec. 2; Victoria, elec. lighting, Dec. 2-7.

" STEAMERS, ocean, berths in, *The Eng.* Feb. 9; U. S. war ships, speeds, Feb. 9; Himalaya, elec. light on, Feb. 9; Oregon, Mar. 2; stm. trials of Satellite under forced draft, Butler, Mar. 23; Violet, Lond. & No. West. Ry. Co. Apr. 13, 13; Lepanto, Ital. Apr. 13, May 11; U. S. navy steel cruisers, Apr. 13; Tartar, June 8; stern wheel, for Magdalena r. June 29-3.

MARINE STEAMERS, Atlan., old and new, *The Eng.* July 6; Austral, stability curves of, Oct. 12; St. Germain's bows after collision, Oct. 12; U. S. twin-screw stm. cruiser, Chicago, Oct. 26, 26; Helvetia, Swiss lake, Nov. 23-3.

" STEAMERS, Abyssinian and b's, *The Eng.* Jan. 4, 11; paddle wheel ambulance, Red Cross, Jan. 11; triple screw, Jan. 11; U. S. cruisers, Jan. 25, Feb. 8; loading by hydr. mach., A. Brown, Apr. 11-25; cargo, Phillip's, Apr. 18; Lake of Lucerne, Apr. 18; English and French fleets, May 16; Atlan., America, July 25, Aug. 1; Chilian cruiser, Esmeralda, Oct. 10, 24; Atlan., speed, n. Oct. 17; do. old and new, Oct. 31-4.

" STEAMERS, Servia, in a gale, *The Eng.* Mar. 20; high speed, Apr. 24; U. S. despatch boat, Dolphin, June 5, July 3; Brit., Benbow, June 12, launch of, June 19; Ireland, Dublin Stm. Packet Co. Aug. 28, 28, Sep. 4, 11; merchant, table, Sep. 4-5; stern wheel, for Nile r. Feb. 5; loss of Oregon, Mar. 19, Apr. 30; Grt. Eastern, May 7; screw engs. of '58, May 14, June 18-6.

" STEAMERS, raising Peer of Realm, *The Eng.* July 9; Atlan. Aug. 13, 13; Allen, Aug. 27; Brit. barbette ironclad, Benbow, Sep. 24; Grt. Eastern, Oct. 15; fuel consumpt., table, Nov. 12-6; light draft river, Jan. 14; river, for Java, Birch, Mar. 4; Pac. Stm. Nav. Co.'s, Oroya, Barrow, bu. Mar. 25, Apr. 1-7.

" STEAMERS, b's. *The Eng.* Apr. 15; changes of level in water surface by skin friction and propellor, Corterill, Apr. 1; cruisers, belted and internal protect., Biles, Apr. 8; Toussant L'Ouverture, despatch boat, Apr. 8; Grt. Eastern, Apr. 8; sizes, Lloyd's return, Apr. 8; Bentwick, indic. diags. Apr. 15; high speed twin-screw, Linnington, Apr. 15; Brit. Sanspareil, May 13; effic., Stroudley, May 27; Normandy, feathering paddles, May 27; stm. vessels, motion of, Mansel, June 24-7.

" STEAMERS, Trafalgar, *The Eng.* Aug. 12; Elbe, stm. pipe explosion on, Sep. 23, Oct. 21; shallow draft, stern wheel, for So. Am., Yarrow, Sep. 30; large, n. Oct. 7; Fifeshire, refrig. mach. on, Oct. 14, 14; Spanish cruiser, fastest in world, Reina Regente, Oct. 14, 28, 28; liquid fuel on Thames r. Nov. 11; Nordenfelt, Dec. 23-7.

MARINE STEERING, engs., 7 by 6 in. *Am. Eng.* May 13-**6**; gear, hydr., Lafarque's, *Eng.* May 11-**3**; do. stm., Britton, Feb. 15-**4**; do. hand-screw, Hastie, May 8-**5**; do. Apr. 30; do. Thompson's, Oct. 1, 8; do. Jochumsen's aux. hydr. Oct. 8; do. stm., Ziese's, Dec. 31-**6**; of Ajax, Froude, May 13; gear, Newcastle exhib. July 22; do. double-screw hand and stm., Napier, Aug. 5-**7**; do. Pepper's, *The Eng.* Aug. 6; do. Maguinnis', Oct. 1-**6**.

" STREPHOMETER, pneu., Schow, *Eng.* Dec. 26-**4**.

" SWIMMING, art of, *Sci. Am. Sup.* Nov. 8-**4**.

" TELEGRAPH, portable ap. at sea, use of, *Elec. World*, Aug. 16; possible meth. of elec. commun. between vessels at sea, A. G. Bell, Oct. 18; elec. do. Nov. 15-**4**.

" THERMOMETER, photo-, Michaelis', *Sci. Am. Sup.* June 21-**4**.

" TORPEDO, Berdan, *Iron Age*, Sep. 24-**5**; boat eng. and fan, Oct. 14; English systems, Nov. 25-**6**; boat catchers, Mar. 10; boats, speed trial, Bussey, May 5; do. twin-screw, Wilborg, May 12; do. b. explosions, English, July 21; resistance expts., English, July 28-**7**.

" TORPEDO, str. Polyphemus, *Mech.* Oct. 6-**3**; boat gun, Hotchkiss, Mar. 15; submar., inventor of, Mar. 29; launching ap., Canet, Apr. 26; boat, fireroom fan, Russian, Nov.-**4**; Italian ram, Etna, comp. twin screw eng. Apr.-**5**; boats, Schichan, Aug, Sep; do. Russian, table, Oct; do. Dec.-**7**.

" TORPEDO, expts. n. *Van Nost.* Nov.-**6**; do. *Ry. & Eng.* Jan; submar. warfare, Jan; boats, Thornycroft, Mar; do. gun, trial, May; do. twin-screw fast, for Ital. govt. June; do. b's, Yarrow, Thornycroft, July; resist. expts., English, Aug; do. Nordenfelt, Sep; Brennan, Oct; battle, Nov; boat, Yarrow, Dec.-**7**; locom. for coast defense, Sleeman, *Electric.* Mar.-**3**; boat, Griswold, Remington, Jan.-**7**; do. elec. *Elec. World*, Jan. 16-**6**; Win's sys. *Elec. Rev.* Nov. 8-**4**.

" TORPEDO boats, *Sci. Am. Sup.* May 19; McEvoy's sys. June 23; boat, Poti, Russian, Dec. 15-**3**; do. do. Feb. 16; do. guns, Hotchkiss, Mar. 15; do. Yarrow, July 5; vessel with pneu. dynamite gun, July 19-**4**; self-propelling and steering, Paulson's, Mar. 21; boat 68, July 25-**5**; use in war, Galbney, Apr. 10, 17; boat, May 29; do. Japanese govt. Aug. 14, Sep. 18; do. and gunboat, Oct. 9-**6**.

MARINE TORPEDO boat, Brit., Yarrow, *Sci. Am. Sup.* Feb. 19; do. catchers, Feb. 26; do. seagoing, Mar. 26; do. Brit. gunboat Rattle-snake, Apr. 16; do. Yarrow, May 7; do. Falke type and German gunboat Eber, July 9; Brennan, Aug. 27; boat, for Spain and Spanish cruiser, Reina Regente, Nov. 19, Dec. 10; do. Nov. 26; do. petrol. burners on, Dec. 17-**7**.

" TORPEDO, attack and defense, *Eng.* Mar. 30; McEvoy's sys. May 11; air compressors for torpedo service, Brotherhood, May 18; boats for Russian and Danish govts. Dec. 28-**3**; do. Jan. 18; do. Yarrow, Jan. 25, Feb. 8; do. armament, Hotchkiss, Feb. 1; do. Argentine govt., Yarrow, Feb. 22; do. Mar. 7; launching ap., Canet, Mar. 14-**5**.

" TORPEDO boats, high speed, *Eng.* May 23; attack and defense, Williams' sys. Oct. 17-**4**; boat engs. and b., Belliss, Jan. 16; Whitehead, autobiography (fiction), Feb. 6–27, Mar. 6–27, Apr. 3, 17, 24, May 8; in war, Mar. 13, June 19; boats, Apr. 24; do. hydr. propul., Thornycroft, July 10; do. Nov. 20; do. Russian govt., Goubet sys. Nov. 20-**5**.

" TORPEDO boat, Falke, Austrian, trial, *Eng.* Jan. 8, Apr. 2; do. comp. condens. engs. Aug. 13; do. b. Aug. 20; do. pumping engs. Sep. 10; do. small, Sep. 10; do. fan and eng. Sep. 24; do. hoisting gear, Oct. 1; do. Chinese govt. Oct. 22; do. Yarrow, Dec. 31-**6**.

" TORPEDO boat, sea going, *Eng.* Feb. 11; do. twin-screw, Ital. govt., Yarrow, Apr. 29; locom., Brennan, June 24, July 1; boat, accident, July 8, 15; do. Ariete, Spanish, July 15, Nov. 4; do. b., water tube, Thornycroft, July 22; do. Yarrow, July 29; do. Dec. 16; do. submarine, Dec. 30-**7**.

" TORPEDO boat resist., Yarrow, *The Eng.* Mar. 30; do. distiller, Normandy's, July 13-**3**; do. Yarrow, May 23; May 30; do. for Russian govt. June 6, engs. June 13–27, b's, July 4, fan, July 18-**4**; vessels, foreign, Feb, 6-**5**.

" TORPEDO boat, Jap. govt. *The Eng.* July 2; do. Russian, Aug. 13; do. do. Wiborg, immersion diags, Oct. 22; vessels and equip. Nov. 5; boat, Yarrow, Dec. 10; do. Peacemaker, Dec. 24-**6**; boat, stat., n. Jan. 7; do. El Destructor, Jan. 14; do. catchers, Jan. 21; do. trials, Mansel, Apr. 29; do. accidents, May 27; do. submarine, Nordenfelt, June 3; do. for Spain, Oct. 21-**7**.

" TOWAGE by endless chains, *Eng. News*, Jan. 12-**4**.

MARINE TUG, propul. against current, *Iron Age*, May 7-**5**; boat, twin-screw, for Rhine r. *The Eng.* June 8-**3**; Sea Gull explosion, Nov. 26-**6**; stm., Jubilee, June 10-**7**.

" VENTILATION sys., str. Preussen, *Eng.* Apr. 8-**7**.

" WATER-SPOUTS, ærial vortices, expts. *Sci. Am. Sup.* Aug. 6-**7**.

" WAVES, oil for stilling, Townsend, *Fran. Inst.* July-**7**; oil expts. in stopping breakers, *Sci. Am. Sup.* Feb. 14-**5**; use of oil at sea, Brit. Admir. rep. Feb. 12; ship, W. Thomson, Oct. 15; ocean, height, Nov. 19; transporting power of, Sep. 10-**7**; do. *Eng.* July 15-**7**; oil on rough water, rep., Sparrow, *Locom.* Oct.-**3**.

" YACHTS, stm., Astor, *Iron Age*, Aug. 30-**3**; do. Livadia, Jan. 10; do. steel, Dec. 11-**4**; do. races, Sep. 2-**6**; do. and Colt disk eng. *Mech.* Apr. 7; Atalanta, Gould, Apr. 21; stm. (Astor), Harlan, U. S. Sep. 8-**3**; do. Livadia, Jan. 5-**4**; do. Am., speed, *Am. Eng.* July 30-**5**; in '84, *Van Nost.* Aug.-**4**; do. *Naut. Mag.*

" YACHTS, measurement and time allowance, *Van Nost.* June-**5**; bu., 50 years of, Kemp, *Ry. & Eng.* June; U. S., Volunteer, Sep.-**7**; stm. twin-screw, Wiegand, *Fran. Inst.* June-**6**; stability and speed of, *Sci. Am. Sup.* May 30-**5**; Galatea, Brit. and Mayflower, Am. Oct. 9-**6**; stm., Chemcheck, June 11-**7**; Am. and English, Oct. 15-**7**; evolution of modern, Burgess, *Soc. Arts*, Jan. 20-**7**; Herreshoff, *Eng.* Oct. 5-**3**; do. *Mech. Eng*; stm., Rosalind, and engs., Cochran, *Eng.* Mar. 21; do. Lady Torfrida, Elder, June 6-**4**; do. Magnolia, Herreshoff, May 29-**5**; Brit. and Am., dimensions, table, Nov. 25; speeds, table, Dec. 9, 16-**7**; stm., Keny's, *The Eng.* Apr. 6; do. Atalanta, Gould's, June 1-**3**; stm., comp. engs., Edinb. exhib. June 18-**6**; Herreshoff, Now Then, Sep. 16-**7**.

MARINERS COMPASS, W. Thomson's, *The Eng.* Jan. 1-**6**.

MARSEILLES, n. *The Eng.* Nov. 2-**3**.

MASON, WM. *Ry. Gaz.* May 25, June 1-**3**; por. *Sci. Am. Sup.* July 14-**3**.

MASS., boundary, *Eng. News*, Oct. 25-**4**; industries, n. *Iron Age*, June 28-**3**.

MATERIALS, strength of large spruce beams, *Fran. Inst.* Feb.-**3**. See also ENG. MATERIALS.

MATHEMATICS, polygon construction, *Eng. News*, Oct. 11-4; arithmetic, early, Aug. 22; Nov. 7, Dec. 19; rapid cals. Nov. 14-5; origin of letter X, Ritter, Sep. 3-7; remarkable number, *Mech.* Apr. 19-4; least squares, adjustment of condition-obs., Wright, *Van Nost.* May, June; division, corrective (short meth.), Miller, Aug.-3.

" DEFLECTING forces of revolving spheroid, Randolph, *Van Nost.* Jan; earth's rotation, Hendricks, Jan; algebra, cain, Mar; geometry, notes, do. May; trig. prob. solution by approximation, Andrews, July-4; correlation of different branches, Hayward, June-6; do. *Nature*; ellipse, property of, D'Auria, *Fran. Inst.* Jan.-7.

" BRIT. ASSOC., Cayley, *Sci. Am. Sup.* Oct. 20-3; parallel curves, MacCord, Jan. 19-4; circle squaring, Bing, Aug. 1-5; radii of curv., det. of, MacCord, Apr. 17, 24; do. geomet. det. do. Sep. 4, 11, Oct. 16, Nov. 13; log. spiral, graph. proc. do. Aug. 14-6; of geodesy *Eng.* Mar. 21-4; ellipsograph, Knott, Feb. 27-5; circle squaring, Bing, *The Eng.* June 5-5.

MATTER, fourth state of, Crookes, *Iron Age*, Dec. 13-3; and "radiant" matter, *Fran. Inst.* Sep-5; forms of vibrating bodies, Decharme, *Eng.* June 12-5. See also PHYSICS.

MAURITIUS, commerce of, *Iron Age*, Nov. 24-7.

MEASURES, English mile, relative to size of earth, and early metrics, Clark, *Van Nost.* May-3. See also WTS. and MEASURES.

MECHANIC ARTS, in Europe, *Fran. Inst.* Jan.-5; abroad and at home, C. Sellers, *Sci. Am. Sup.* Mar. 14-5.

MECHANICAL, tracts, *Am. Eng.* Mar. 30, Apr. 6, 27, May 11-7; conundrum, *Ry Gaz.* July 30, Aug. 6, 20-6; integrators, Shaw, *Van Nost.* Nov, Dec.-5; motors, cannon, stm. eng., man and insect as, Jouffret, *Sci. Am. Sup.* Dec. 8-3; equiv. of heat, *Eng.* May 30, June 20-4; education, Oct. 29-6; movement, Kubec's, *The Eng.* Mar. 28-4; do. *Sci. Am.* See also ENG., MECHAN.

MECHANICS, prob., Trautwine, *Eng. News*, May 9, 16-5; inertia, Hall, *Mech.* May 3-4; Schiele's anti-friction curve, Jan, Apr.-6; screw, perfect, prob. sol., Rogers, *Van Nost.* Oct.-4; screw, applied to fine arts, Simonds, June-5; rotary motion analysis as applied to gyroscope, Barnard, Dec.-6.

MECHANICS, Sellers, *Fran. Inst.* Mar, Apr.-**4**; harmonic motion, Jan. -**5**; particle in rotating tube, Church, Sep.-**7**; motion, perpetual, Mitz and Lamy's, *Sci. Am. Sup.* Nov. 10-**3**; Lodge, book n. *The Eng.* Oct. 23-**5**. See also MECHANISM.

MECHANISM, wheel-trains, planetary, MacCord, *Sci. Am. Sup.* May 17, June 14, Aug. 23-**4**; do. do. Jan. 3, Mar. 28-**5**; sphere and roller, Shaw, May 21, simul. dead points, MacCord, Oct. 8–29-**7**; theatre, Jan. 2, 23, May 22-**6**; do. at Lyceum theatre, *The Eng.* Apr. 2-**6**. See also MECHANICS.

MELOGRAPH and melotrope (music registering mach.), Carpentier, *Sci. Am. Sup.* Aug. 20-**7**.

MEN, power of, the spymograph, n. *Eng. News*, June 30-**3**; hist., unwritten, Evans, *Sci. Am. Sup.* Jan. 27; running, instantan. photos. Dec. 8-**3**; hygiene of the feet (shoe design), Lee, July 5-**4**; possible suspension of old age, S. W. Caldwell, May 23-**5**; making of, C. Morris, Aug. 7; circul. of blood cxpts., Mosso, Dec. 11-**6**; stature variations, Apr. 16; life energy, Alcock, Apr. 30; longevity, human, June 25-**7**.

MENSURATION, Cooper, *Mech.* Feb.-**7**.

MERCURY, distiller, J. W. Clark's *Sci. Am. Sup.* Feb. 9-**4**; pump, mercurial air, S. Thompson, *Eng.* Nov. 25-**7**. see also METALS, MERCURY.

MERRILL, SHERBURNE S. *Ry. Gaz.* Feb. 13; por. Mar. 20-**5**.

METAL, shearing mach. for large plates, Donnay, *Iron Age*, Feb. 8; cutting, modern meths., W. F. Smith, May 10, 17; Exchange rules, N. Y. June 28; market, '83, review of, Dec. 27-**3**; working mach., Cornice, litigation on, June 19-**4**; market, '85, review of, Jan. 7; do. annual review, Dec. 30-**6**; do. do. '86, Jan. 6-**7**; and trade reps. *Iron Age* files.

" WORKING industries, Am. and English practice, *Mech.* May 12; cutting, meths., W. F. Smith, May 19, June 9, 23, 30-**3**; casting upon lace, etc., Outerbridge, *Fran. Inst.* June-**3**; castings from carbonized fabrics, do. rep. Nov.-**7**; do. do. *Sci. Am. Sup.* Nov. 12-**7**; saws, Craven, *Eng.* June 17-**7**.

METALS. See also IRON AND STEEL; METALLURGY; STEEL.

" AN. REVIEW, '84, *Iron Age*, Jan. 1; flow of, early expts. July 30; an. review of, '85, Dec. 31-**5**; and alloys, oxygen in, Jan. 7, 14-**6**; sheet ceiling wk. Dec. 29-**7**; early hist. *Mech.* Feb. 23, Apr. 5-**4**.

METALS, flow of, early expts., Ward, *Mech.* June; oxidation of, and Bower-Barff proc., Weightman, June; oxygen and oxides in, Nov.-**5**; alloys, melting points, Dec.-**7**; do. do. *Sci. Am*; sheet, flow of in drawing proc. *Fran. Inst.* Nov; alkali production, Nov.-**6**; vapors of, Parry, *Sci. Am. Sup.* Dec. 27-**4**.

" CRYSTALLINE ALLOYS, Pearce, *Sci. Am. Sup.* Nov. 14-**5**; welding, Lafitte proc., W. Anderson, Oct. 16-**6**; and alloys, colors of, Austen, Feb. 5; expan. of, ap. for, June 25; hardness of, Turner, July 2, 16-**7**; and alloys, conductivity, *Eng.* July 25-**4**; flow of, Ward, June 12-**5**; properties common to fluids and, May 28-**6**; impurities in, Austen, *The Eng.* Mar. 26-**6** and before; flow of, Feb. 18-**7**.

" ALUMINUM, *Eng. News*, Jan. 12-**4**; manuf. proc. *Iron Age*, Jan. 18; alum. bronze. frictional tests, Self, May 26; alloy tests, Cowles, Sep. 1-**7**; *Am. Eng.* Feb. 11; alum. bronze casting, etc., T. D. West, Dec. 22-**6**; do. do. *Ry. Gaz.* June 10; alloys, Oct. 21-**7**; *Fran. Inst.* June-**3**; and its alloys, expts., Self, Mar.–May-**7**.

" ALUMINUM, Van der Weyde, *Elec. Rev.* Oct. 3, Nov. 21-**5**; Price, Jan. 30-**6**; discov. Mar. 26-**7**; in Nev. *Sci. Am. Sup.* Mar. 8-**4**; and extraction, Seymour, May 23-**5**; Price, Mar. 6; Aug. 14-**6**; Mar. 19-**7**; and its alloys, prodnction of, and Cowles' elec. furnace, Cowles, *Soc. Arts*, Feb. 11-**6**; *Eng.* July 9-**6**; Jan. 14, Mar. 25-**7**.

" BRONZE, tempering, *Eng. News*, Mar. 1-**4**; alloys, *Iron Age*, Nov. 27, Eec. 4-**4**; June 4-**5**; strength of, Thurston, *Ry. Gaz.* Ang. 7-**5**; strongest, *Fran. Inst.* Feb.–Apr.-**4**; casting, *Sci. Am. Sup.* Aug. 2; alloys for eng. purposes, Nursey, Nov. 29-**4**; do. *Van Nost.* Jan. 5; casting, Boehm, June 13-**5**; do. artistic, Simonds, Mar. 20-**6**; strongest of, *Eng.* July 1-**4**. See also METALS, MANGANESE, PHOSPHOR BRONZE.

" COPPER, in U. S., '72–'82, *Eng. News*, July 21-**3**; indus. of U. S. *Iron Age*, Oct. 4, 11; markets, European and Am. Nov. 15-**3**; May 8; gold, silver, copper, lead produc. U. S. Feb. 7; production of world, Feb. 7, June 5-**4**; do. June 4-**5**; do. May 27-**6**; do. Apr. 21-**7**; Spanish, May 14-**5**; and lead, prices chart, Jan. 21; Spanish Co.'s, May 13; mines, lake, '86, Apr. 7; great German Co. June 30-**7**; iron, steel, and effect of heat and cold on, *Mech.* Oct.-**5**; do. do. Wehrenfarning, *Van Nost.* Feb.-**6**.

METALS, COPPER, tin-zinc alloys, U. S. testing bd. rep. *Am Eng.* Nov. 21-**4**; and brass, *Electric.* July-**5**; produc., U. S., '86, May-**7**; mining indus. *Elec. Rev.* July 5-**3**; stat. of world, Mar. 7-**5**; alloys among ancients, Reyer, *Sci. Am. Sup.* Sep. 29-**3**; refining, electrolytic, Aug. 8-**5**; crystallization, Dana, Jan. 8-**7**; mining, L. Superior, Rathbone, *Eng.* Feb. 25, Mar. 4-**7**; and lead produc., U. S., n. *The Eng.* Nov. 26-**6**. See also METALLURGICAL.

" DELTA METAL, tests, German, *Eng. News*, Sep. 6-**4**; alloys, *Mech.* Mar. 24-**3**; (iron and bronze), *Am. Eng.* Jan. 9-**5**; alloy, *Lcom.* July-**3**; do. new, Dick, *The Eng.* Feb. 23-**3**.

" DENTAL AMALGAM, Best, *Sci. Am. Sup.* June 7-**4**.

" GOLD, (gold, silver, copper and lead) production, U. S. *Iron Age*, Feb. 7-**4**; discov. in Cal. Aug. 27; and silver produc., U. S., '84, Oct. 8; first discov. in Cal. Nov. 26-**5**; and silver, Mint rep. June 2-**7**; mystery, comp. *Fran. Inst.* Nov.-**6**; ore, electro-amalg. of, *Elec. Rev.* Mar. 29-**3**; and silver produc., U. S. June 14-**3**.

" GOLD, ore, electro-amalg. of, *Eng.* Mar. 9-**3**; and silver, Russell's leaching proc., Egleston, Sep. 12-**4**; do. treating, U. S. Mint, July 9, 16, Aug. 13, Sep. 3; do. Royal Mint, Aug. 20-**6**; ores, containing silver, leaching of, Egleston, Mar. 4, 11; and silver produc. of world, Topley, Sep. 16; do. geolog. distribution, do. Oct. 14, 21-**7**; production, U. S., '85, n. *The Eng.* Oct. 15-**6**.

" IRIDUM, industry, *Iron Age*, Mar. 13-**4**; smelting, Dudley, *Mech.* Mar. 3-**3**; indus. do. Apr. 5-**4**; do. *Fran Inst.* July-**4**; do. *Elec. Rev.* July 12-**4**; do. W. L. Dudley, *Sci. Am. Sup.* Aug. 9-**4**.

" LEAD, markets, European an Am. *Iron Age*, Oct. 4; indus. of U. S. Oct. 18-**3**; production, U. S. Feb. 7; do. '83, Mar. 20-**4**; copper, and prices chart, Jan. 21-**6**; burning, *Am. Eng.* Sep. 15, 29, Oct. 6, 13-**6**; wks., Dee, Walker, *Eng.* Sep. 26-**4**.

" MANGANESE BRONZE, and phospher, *Eng. News*, May 23-**5**; P. M. Parsons, *Van Nost.* Jan.-**4**; *Sci. Am. Sup.* Feb. 2-**4**.

" MERCURY, trade, *Iron Age*, Dec. 18-**4**; quicksilver markets since Dec., '85, June 9-**7**. See also MERCURY.

" NICKEL, produc., New Caledonia, *Iron Age*, Feb. 11-**6**; and alloys, June 2-**7**; plating, Warren, *Sci. Am. Sup.* Mar. 26; and alloys, July 2-**7**; and zinc, quicksilver produc., U. S. *The Eng.* Dec. 3-**6**.

METALS, PHOSPHOR and manganese bronzes, *Eng. News*, May 23-5.

" SILVER, and gold, copper, lead produc., U. S. *Iron Age*, Feb. 7-4; and gold, produc., U. S., '83, Oct. 8-5; do. Mint rep. June 2-7; do. produc., U. S. *Elec. Rev.* June 14-3; ores, amalgam. *Eng.* Aug. 22; and gold, Russel's leaching proc., Egleston, Sep. 12-4; do. treating, U. S. mint, July 9, 16, Aug. 13, Sep. 3; do. Royal mint, Aug. 20-6; the world's n. Feb. 25; gold ores containing, leaching of, Egleston, Mar. 4, 11; and gold produc. of world, Topley, Sep. 16; do. geolog. distrib. do. Oct. 15, 21-7.

" SOLDERS, testing, *Iron Age*, Oct. 29-7; *Am. Eng.* May 11-7.

" SODIUM, *Eng.* Jan. 28-7.

" SPELTER, foreign trade in, *Iron Age*, Apr. 19; May 31-3; world's produc. May 6-6.

" TIN, *Iron Age*, Mar. 13; plate, classification, Jan. 31; do. manuf. July 17, 24; do. U. S. Aug. 21; plates, Nov. 20-4; Banca mines, Apr. 30; plate manuf., U. S. Feb. 12, Apr. 9, 30; and pickling mach. June 4; recovery from scrap, July 23-5; Sep. 2, Nov. 4; deposits of Straits Settlements, Nov. 25-6; plate manuf., Stercken, Nov. 24, Dec. 1, 15, 29.7; and copper-zinc alloys, U. S. testing bd. rep. *Am. Eng.* Nov. 21-4; Blake, *Sci. Am. Sup.* Mar. 20-6; produc. of world, n. *Eng.* Nov. 18-7.

" ZINC, indus. in U. S. *Iron Age*, Sep. 27-3; Belgian wks. July 31-4; indus., U. S. and foreign countries, Sep. 10; ore deposits of Va. and E. Tenn. Sep. 10-5; and copper-tin alloys, U. S. testing bd. rep. *Am. Eng.* Nov. 21-4; mines, N. J., Darton, *Sci. Am. Sup.* July 14; manuf., Sincay, Sep. 15-3; do. in Belgium, *Eng.* Aug. 3, 24-3; produc. in Europe and U. S. *The Eng.* Sep. 17-6.

METALLURGICAL, gas furnace, *Iron Age*, May 19-4; electro-, plant for copper extraction, *Elec. Rev.* Nov. 22-4.

METALLURGY, reduction of oxydized iron by carb. oxide, Akerman, *Iron Age*, Apr. 5; in Sweden, Nov. 8, 22-3; refractory ore elec. furnace, Cowles, T. S. Hunt, *Am. Eng.* Sep. 24-5; Duncom concentrator, June 10; copper smelter, Pacific furnace, June 10-6; electro-, of copper, *Elec. World*, Oct. 31-5; do. *Eng.* Sep. 25-5; produc. of aluminum and alloys in elec. fur., Cowles, *Elec. World*, Feb. 27; Cowles' Smelting Co., water power, Lockport, N. Y. Feb. 5-7.

METALLURGY, Wood r. smelting wks. *Sci. Am. Sup.* Jan. 27; det. of lead from its ore by electrolysis, Sommer, June 16; concentrating mill at O'Neil mines, Galena, Kan. July 21-3; gold chlorination in Cal., Browning, July 12; deposition of ores, Newberry, July 19; electro magnetic ore dressing, Aug. 9; gold extraction, Aug. 23; amalg. of silver ores, Rathbone, Francke Tina proc. Oct. 11-4.

" ORE milling stamps vs. rolls, Stetefeldt, *Sci. Am. Sup.* Feb. 14; copper matte electrometallugic treatment for cu. extraction, Sestri-Levante estab. Feb. 28, Mar. 7; rapid smelting plant, Stewart's, June 27; of iron (direct proc.), Oct. 24-5; silver and lead smelting in Col. Nov. 13-6; electro-, Mar. 12; lead smelting, Lewis-Bartlett proc., Ramsay, May 14-7; copper mattes, bessemerizing of, Peters, *Soc. Arts*, Feb. 24-7.

" PRUSSIAN MINING, and, *Eng.* June 6; silver ore amalg. June 13-4; lead smelting proc. July 31; electro-, of copper, Sep. 25; silver ore furnace, Stetefeldt, Egleston, Sep. 25; rolls for crushing ore, do. Nov. 13-5; silver and lead smelting in Col. Sep. 10: roller mill, Mumford, Sep. 17-6.

" MACH., gold stamper bat., Daglish, *Eng.* Feb. 11; leaching of gold ore containing silver, Egleston, May 6-20; pneu. ore pulverizing mach. July 8; gold extraction from ores, Aug. 26; of gold, silver and mercury in U. S., Egleston, Sep. 9; do. do. bk. n. Oct. 21; reduction of ores, Bell, Sep. 23; extraction of gold from ores, Newbery-Vautin chlorination proc. Sep. 30-7.

" SILVER ore amalg., Rathbone, *The Eng.* Aug. 8-4; Queensland gold quartz mill, Colonial exhib. July 16; copper ore smelting cupola, Stewart's rapid, Dec. 24-6; stm. stamp ore crusher and amalg., William's, Mar. 25; hydr. separators, Mar. 25-7.

METEOROGRAPH, Rysselberghe, *Eng.* May 9-4.

METEOROLOGY, anemometer, Bourden, *Mech.* Mar. 3; actinometers, Dec. 8-3; barometer and weather, *Van Nost.* Nov.-4; *Mag*; and other registers, rep. *Fran. Inst.* Mar; do. *Naut.* tornado study, Apr.-6; popular errors in, Abbe, Feb.-7.

" REGISTERING AP., Richard's barom. and thermom. *Sci. Am. Sup.* Apr. 7-3; instrums., Vesuvius observ. Oct. 24-5; clouds, forms, Apr. 17-6; errors in, Abbe, Feb. 26-7; committee rep., W. H. Niles, *Soc. Arts*, May 10-3; do. do. May 8-4; do. do. May 14-5; do. do. May 13-6; do. do. May 12-7.

METEOROLOGY, Fisheries exhib. *Eng.* Jan. 15-**3**; barometric observs., reduction to sea level, Feb. 22-**4**; instrums., self-recording, Draper, Dec. 4-**5**; elec. scale reader, Sep. 24-**6**; instrums., Anemogene, Rougerie, (rotation earth and wind currents), Feb. 18; hygrometrical obs. Apr. 22; seismographs, Ewing, Tokio, June 3-**7**; R. Scott, *The Eng.* May 25-**3**.

METERS, Ashton's power, *Iron Age*, Oct. 15-**5**; for power and electricity, Boys, *Mech.* Aug. 18-**3**; Siemen's Watt, *Eng.* Dec. 21-**3**. See also DYNAMOMETERS; ELEC. METERS.

METRIC SYSTEM, *Iron Age*, Oct. 16-**4**; *Mech.* Nov.-**4**.

MEXICO, pub. wks. and people, *Eng. News*, Jan. 12-**4**; imports and exports, *Iron Age*, Sep. 6; proposed commercial treaty with, and U. S. Nov. 15, trade, Dec. 27-**3**; crisis, July 2; finances, Sep. 3; metal manuf. trade, Sep. 3; Am. hardware in, Sep. 17-**5**; pop., chart and stat. *Ry. Gaz.* July 10-**5**; debt, June 17-**7**; do. *Elec. Rev.* Dec. 20-**4**.

MILITARY ENGINEERING. See also ARMIES; GUNNERY AND ARMOR.

" ARMY mess hall, David's Is., N. Y. har. *San. Eng.* Sep. 10-**7**; Bange's artillery sys. *Sci. Am. Sup.* Mar. 1, May 17; torpedo launching ap. May 24; railroad transportation, Nov. 1; bread ovens in field, Nov. 26; coast defense by elec. torpedoes, Win's sys. Dec. 13-**4**.

" HARBOR, port. defense by torpedoes, *Sci. Am. Sup.* Mar. 14; elec. light ap. May 9; teleg. June 13; telemetrograph (drawing plans by telescope), Aug. 1; siege of Alexandria by Caesar, Sep. 12-**5**; attack formations, Aug. 6-**7**; steel for warfare, H. M. Howe, *Soc. Arts*, Oct. 14-**6**.

" TELEGRAPHY, telephone in, *Eng.* June 4; and sporting rifle, Rees, June 25; Dredge omni-telemeter, Aug. 20-**6**; cutlasses and bayonets, defective, Apr. 29-**7**; elec. torpedoes and coast defense, William's sys. *The Eng.* Oct. 17-**4**; horse and field artil. guns, 12-lb. field, Oct. 21-**7**.

MILK-CAN, Deerfoot safety, A. P. Browne, *Sci. Am. Sup.* Apr. 24-**4**.

MILLING MACH., vs. planer, Grant, *Iron Age*, Dec. 1; Niles, Dec. 15-**7**; Hewes, *Mech.* June 2; vertical, Bliss, Sep. 22-**3**; do. French, Jan. 19-**4**; as substitute for planer, J. J. Grant, Dec.-**7**; do. do. *Am. Eng.* Nov. 23-**7**; French, *Sci. Am. Sup.* May 30-**5**; Lipe, eng. *The Eng.* Apr. 4-**4**.

MILLS and factory bu., evolution of, *Iron Age*, Aug. 26-6; English cotton, *Mech.* Nov. 24-3; distrib. of power in woolen mill, *Am. Eng.* May 27-6; architecture, *Fran. Inst.* July-5.

" STEAM plants for, C. H. Manning, *Sci. Am. Sup.* Apr. 23-7; sprinklers, aut., for protection against fires, Woodbury, *Soc. Arts*, May 21-5; floors for light mach. *Eng.* Feb. 27-5; comp. eng., Marky, Dresden, May 6, 27-7; factory depreciation Matheson, *The Eng.* Sep. 14, 14, Oct. 12, 19 Nov. 9-3; rope driving gear, Jan. 11-4. See also FLOUR MILLS.

MINERALS, products of U. S., '85, *Eng. News*, Oct. 30-6; wealth of Tarquin and Annam, *Iron Age*, Oct. 11-3; English stat., '83, Aug. 21-4; rare, for manuf. purposes, Dec. 24-5; products, U. S., '86, July 28-7; do. Williams, rep. *Am. Eng.* June 26-5; Germanium, Weisbach, May 18, 25, June 1-29-7.

" PRODUCTS, U. S. *Ry. Gaz.* Aug. 3-3; do. A. Williams, rep. *Van Nost.* Jan.-6; crystallization, *Fran. Inst.* Aug.-5; and rocks, the useful, *Sci. Am. Sup.* Sep. 6-4; products of U. S. *Eng* Sep. 14-3; wagons of So. Wales, Nov. 28-4; produc., U. S., William's rep. *The Eng.* Jan. 25; resources of U. S. Aug. 8-4; rare, for manuf. purposes, Nov. 27-5; of U. S. May 28-6.

MINERS, inch of water, *Iron Age*, May 13-6; safety lamps, Aug. 23-3; do. *Eng.* Sep. 17-6.

MINING ENGINEERS, Am. Inst., pro. *Eng. News*, June 16-3; *Iron Age*, Mar. 1, June 14, Oct. 18-3; Feb. 28, Mar. 6, June 5, 12, Sep. 11-4; Feb. 19, 26, Mar. 5, May 28, Sep. 24, Oct. 1, 8-5; Feb. 18, Mar. 4, 11, May 27, Oct. 21-6; Feb. 24, Aug. 4-7; *Mech.* Mar. 8, 15, June 14, 21-4; *Ry. Gaz.* Feb. 25, Aug. 12-7; *Ry. & Eng.* Sep.-7; *Eng.* Oct. 16-30-5; Mar. 26, Apr. 2, June 25, July 2, 9, Nov. 19-6; Apr. 15, 22-7.

" ENGINEERING. See also COAL; ENG; do. CIVIL, MATERIALS; EXPLOSIVES; Bramall, *Eng. News*, Dec. 13, 20-4; Divining-rod, Raymond, Sep. 29, Oct. 6, 20-3; shaft sinking, thro. quicksand, England, Ritson Wilson, Feb. 2; do. by freezing. Poetsch meth. June 7, July 5; drill hole tamping with plaster of Paris, Easton, Aug. 9; submarine blasting, Laner's meth., Specht, Aug. 23-4; by compressed air, Johnson, Apr. 11; shaft sinking thro. water-bearing loose materials, J. E. Mills, Apr. 25-5; do. Parker, Dec. 3-7; rock drill, Barrow, Dec. 12-5; do. Githen's, Mar. 26-7.

MINING, Comstock lode, *Iron Age*, July 12; divining rod, Sep. 20, 27, Oct. 11-**3**; do. *Fran. Inst.* Jan, Feb.-**5**; in China, Oct. 2; rock drill, Nov. 20-**4**; iron ores, Va. Jan. 15; rock breaker and ore crusher, Brennan, Mar. 18; plant, Dickerson mine, Apr. 29; do. Cal. & Hecla copper, July 15-**6**; regions of L. Superior, map, Birkinbine, Aug. 4-**7**; shaft sinking thro. quicksand, Andre, *Mech.* Dec. 22-**3**; Rand rock drill, Halsey, Dec.-**4**.

" EXPLOSIVES, use of, Sumet, *Am. Eng.* Aug. 22, Sep. 5; hoisting engs., Lidgerwood, Oct. 17-**4**; centrif. ore pulverator, Waring, Aug. 10, 17-**7**; shaft sinking in watery running ground, Galloway, *Van Nost.* Dec.-**3**; do. thro. water-bearing loose materials, Mills, Mar.-**5**; elec. drilling, Taverdon ap. *Elec. World*, July 26; elec. power transmission in, Schulz, Nov. 22-**4**; elec. locomotive, Reckenzaun's, May 22, July 24-**6**.

" ROCK DRILL, Welker's percussion, *Sci. Am. Sup.* Jan. 27-**3**; shaft sinking thro. quicksand, by artif. freezing, Jan. 19, Mar. 1; do. H. W. Hughes, Dec. 20-**4**; compressed air locom. Mar. 15; blasting, elec. mach., Bornhardt's, June 14; elec. drill, Taverdon's, Aug. 23; Cal. & Hecla lifting wheels, Sep. 6; hydr. in Cal., G. O'Brien, Sep. 20; diamond, mach., Brazil, Oct. 11-**4**.

" SHAFTS, deep, and, *Sci. Am. Sup.* Sep. 26; shaft sinking, Quievrechain working, Sep. 26; portable prospecting drill, Dec. 19-**5**; shafts, sinking, Poetsch's meth. Apr. 17; do. tubes and air lock testing, Brennecke, June 12-**6**; gold, mach. May 14; iron ore exploring, use of magnetic needle in, Brough, Aug. 27-**7**; coal, Buck, *Soc. Arts*, Mar. 10-**7**.

" GOLD, Siberia, *Eng.* Feb. 23, Apr. 6-**3**; and metallurgy, Belgian, July 25-**4**; rock drill, Cranston, Oct. 30; do. Barrow, Beaumont, Nov. 6; do. Adelaide, Dec. 24; mach., Inv's exhib. Oct. 30, Nov. 6-**5**; hauling mach., Palermo, Italy, Jan. 15; quartz mill, Disraeli, Mar. 5; roller wedge, Burnetts, Sep. 24; silver mills, Lexington, Butte C., Mont. Dec. 24-**6**.

" COPPER, mach. *Eng.* Feb. 25, Mar. 4; submarine, personnel for, Bucknill, Mar. 25, etc; do. Oct. 14-28, Nov. 4, 11, Dec. 2, 23; fireless locom., Halle, Aug. 5; gold, Mount Morgan, Dec. 16-**7**; submarine, *The Eng.* Aug. 17-**3**; shaft sinking mach., thro. loose materials, Am., J. B. Mills, Feb. 6-**5**.

MINING, rock drill, Barrow's, *The Eng.* June 12; exhib., Glasgow, Nov. 6, 20-5; gold, mach., Transvaal, Louis, June 17-7.

MINES, diamond fields of So. Africa, *Eng. News*, June 30-3; fire bulk-head, Rolker, May 2; 3,000-ft. shaft, Comstock lode, Aug. 29; accidents, Parent, Aug. 29, Sep. 5-5; do. in (ventil.), Sep. 25, Oct. 2-30, Nov. 6-27, Dec. 4, 11-6; iron, Hudson r. *Iron Age*, May 24; zinc, of Sussex City, N. J. July 19; iron ore and wks. at Bilbao, Oct. 25-3.

" IRON, Minn. Iron Co. *Iron Age*, Apr. 23-5; do. Apr. 14, 21-7; do. ores of Tenn. r. valley, Aug. 6-5; do. L. Superior, in '85, Jan. 14, Apr. 1; do. Gogebic, Sep. 9, range Dec. 2-16; Alaska, Sep. 23; Rand quarry bar drill, Sep. 30-6; Kingston & Pembroke Co. June 2; Vermillion lake, Aug. 4; Gogebic iron range, map, Aug. 11, 18-7; centrif. ventilators, Murgue, *Van Nost.* Sep.-3; coal, spontan. combust. in, Durand, Nov.-4.

MINES, standpipe, Calumet, *Sci. Am. Sup.* Feb. 10-3; Cal. & Hecla, and plant, Aug. 16-4; do. *Eng. & Mining Jour*; fire-damp detector, Garforth's, *Sci. Am. Sup.* Oct. 25-4; ventilator, Korting's jet, Apr. 4; magnesia, at Aigues-Mortes, Apr. 25-5; phosphate, of Canada, Mont. Apr. 17; Kimberley diamond, Africa, Aug. 7-6; do. Aug. 20-7; do. So. Africa, *Locom.* July-5.

" PUMP, Deane sinking, *Eng.* Aug. 10-3; diamond fields, So. Africa, Aug. 29-4; do. Apr. 23, May 14, 28, June 4, 18, July 9, 23, Aug. 13, Dutortspan, Oct. 29, Kimberley, Nov. 12-6; do. do. Aug. 26, Sep, 2; accidents, June 3-7; do. *The Eng.* Aug. 3-3; magnesia, Aigues-Mortes, Mar. 20; Athus district, map, Mar. 27-5; Rio Tinto (Red r.), Spain, Sep. 16-7.

MINT, Brit. *Mech.* Aug. 25-3; Royal, *Sci. Am. Sup.* Sep. 25-6.

MOLDING MACH., instrum. for marking cutters, *Mech.* June 16-3.

MONEY, legal tender paper, *Iron Age*, May 15-4; paper currency and gold and silver coinage of world, *Elec. Rev.* Apr. 4-5; new Brit. coinage and jubilee medal, *Sci. Am. Sup.* July 9-7; how it is spent, U. S. stat., '85, *Locom.* Sep.-6; bi-metallism, *Eng.* Oct. 7; do. hist. chart, Koch, Dec. 30-7; gold production, U. S., '85, n. *The Eng.* Oct. 15-6, See also METALS, GOLD; SILVER; MINT.

MONTREAL City rep., n. *Eng. News*, Nov. 13-6.

MORLEY, WM. K. *Eng. News*, Jan. 27-3.

MORRISON, JAMES F., por. *Elec. World*, Aug. 7-**6**.
MOTOR, domestic, Darcy, *Iron Age*, Oct. 14-**6**. See also AIR, GAS ENG; ELEC. DYNAMO MOTORS, ETC.
MT. BLANC, ascent of, *Sci. Am. Sup.* Oct. 29-**7**.
" DESERT, Green Mt. Ry. *Fran. Inst.* Sep.-**3**.
MULE SPINDLE, duplex, *Sci. Am. Sup.* Apr. 7-**3**.
MURDOCK, WM. *Eng News*, Dec. 1-**3**.
MUSEUMS, commercial, Europe, *Iron Age*, Dec. 10-**5**.
MUSIC reading, Kroeh, *Sci. Am. Sup.* June 7-**4**.
MUSICAL pitch, det., hist. and present standards of, Cross, *Soc. Arts*, Apr. 24-**4**.
MUSK, *Sci. Am. Sup.* Mar. 19-**7**.
NAIL MACH., wire, Hutchins, *Iron Age*, June 9-**7**; hob, *Mech.* Feb. 2; cut, Am. N. Co. Apr. 5-**4**; wire, Lovell, *Eng.* Mar. 11-**7**.
NAILS and bar iron prices, chart, *Iron Age*, Jan. 14-**6**; cut and wire, comparative value, Oct. 6, 20-**7**.
NAPIER, ROBERT D. *The Eng.* May 15-**5**.
NAPLES, Vesuvius observ., Marcillac, *Sci. Am. Sup.* Oct. 24-**5**.
NASMYTH, JAMES, *Sci. Am. Sup.* Apr. 14-**3**.
NATIONS, debts of, *Iron Age*, Oct. 2-**4**.
NEW MEXICO, roadways of, Pullen, *Soc. Arts*, Mar. 11-**6**.
NEWSPAPERS, stat. of world, *Iron Age*, Aug. 27-**5**; current facts about, *Locom.* Aug.-**6**.
NEWTON, ISAAC, *Sci. Am. Sup.* Apr. 17-**6**.
NEW YORK CITY. See also BUILDING; RAILROADS; RAILWAYS, ELEVATED, UNDERGROUND, ETC.
" BUILDINGS, *Eng. News*, Jan. 5, May 31; pub. wks. rep. Mar. 15; and Penn. boundary survey, Oct. 25; travel growth (rapid transit), Haupt, Nov. 8-**4**; do. Feb. 21; bd. pub. wks. rep. Mar. 7, June 13, Nov. 21; Broadway traffic, n. July 11; traffic growth, Nov. 7, 28-**5**; mayor's message, Jan. 9; bd. pub. wks. rep. Feb. 13; tenement h's, Oct. 2-**6**; bu. prog. Jul. 2; traffic growth, Oct. 15; munic. bu's, Dec. 3; traffic, notes, Dec. 31-**7**.
" INDUSTRIES, *Iron Age*, Mar. 29; growth of, Apr. 5; bu. growth, July 12; bu. in, Sep. 13-**3**; real estate vals. Dec. 24-**5**; imports, hardware, iron, steel and metals, Dec. 2; as a commercial center, Dec. 9-**6**; exports and imports, *Ry. Gaz.* Sep. 7-**3**; city pass. travel, Jan. 14-**7**; rapid transit in, May 21-**6**; do. Feb. 18, July 15-**7**.

NEW YORK C., pass. transport., n. *Van Nost.* Aug.-**6**; st. lighting costs, *Elec. World*, May 2-**5**; pass. traffic, *Sci. Am. Sup.* Oct. 10-**5**.

NEW ZEALAND, finances, *Iron Age*, Dec. 8-**7**; *Eng.* July 1-**7**.

NIAGARA Falls and r., depth and quantity, *Iron Age*, Oct. 26-**3**; rate recession of Falls. Aug 6; power of, Sep. 24-**5**.

NICE IRRIGATION WORKS, *Eng.* Jan. 2, 16-**5**.

NICHOLS, WM. R., Swain, *Sci. Am. Sup.* Apr. 30-**7**.

NICKEL PLATE decis., Blatchford, *Iron Age*, Feb. 22-**3**.

NORDENSKJOLD, ADOLF ENK, por. *Sci. Am. Sup.* Nov. 3-**3**.

NORTH POLE exped., search for Greely, map, *Sci. Am. Sup.* May 31-**4**.

NORWAY AND SWEDEN industries, *Eng.* Feb. 8-**4**.

NOSTRAND, VAN, David, obit. *Van Nost.* July-**6**.

OCEAN CURRENTS, measurements by hydrometric wheel, *Eng. News*, Nov. 14-**5**. See also MARINE, OCEAN, SEA, ETC.

OIL MILL, mach. *Sci. Am. Sup.* May 17-**3**; England, Jan. 26-**4**; plant do., Gruning, des. Jan. 29-**7**; mills, do. *Eng.* Dec. 17-**6**; *The Eng.* Nov. 23-**3**; Rose, eng. Aug. 21-**5**.

" TESTING MACH., railroad, Thurston's, *Am. Eng.* Feb. 25-**6**; do. *Ry. Gaz.* Feb. 19-**6**; do. *The Eng.* June 4-**6**. See also ENG., MECHAN., FRICTION AND LUB.

OILS, cotton seed mach. and manuf. *Iron Age*, July 23-**5**; do. Thompson, *Mech.* July-**5**; mineral, fire test, Feb. 2-**4**; oil from corn, Green's proc. *Fran. Inst.* Mar.-**6**; in Cal. *Sci. Am. Sup.* Mar. 29; kerosene, origin of name, Apr. 5; linseed, botany and chem., Earle, Aug. 2-**4**; detection of adulterations, O. C. Carter, Nov. 14-**5**; solidified, Wright, Mar. 12-**7**; Dee wks. *Eng.* Sep. 19-**4**; distil. of shale, Young, May 8; menhaden and guano, July 3-**5**.

" LUBRICANTS, and friction measurements of, *Iron Age*, Nov. 27-**4**; lub. devices, Senderling, Oct. 8-**5**; lubs., Lux, *Van Nost.* Dec.-**3**; lubs., val. by consumers, *Fran. Inst.* July, Aug.-**5**; friction measurements, Woodbury, *Eng.* Dec. 5-**4**. See also ENG., MECHAN., FRICTION AND LUB; PETROLEUM.

ORANGE FREE STATE, So. Africa, pub. wks., Halle, *Am. Eng.* Aug. 20-**5**.

ORGAN, spec., Temple ch., London, *Sci. Am. Sup.* Feb. 3-**3**; largest, Riga cath., Russia, Nov. 1-**4**; Wedlake's, Dec. 26-**5**; Liverpool, exhib. Oct. 23; in Westminster Abbey, Jan. 23-**6**; do. *The Eng.* Aug. 21, 21, 28, 28; Wedlake's, Nov. 13, 13-**5**.

OXYGEN, liquefying proc., Carlletet, *Mech.* Nov.-5.
OZONE MACH., *Elec. World*, Sep. 19-5.
PAINE, WM. H., por. *St. Ry. Gaz.* Sep.-6.
PAINT, sienna, burnt and raw, *Eng. News*, Dec. 22-3; luminous, Balmain proc, *Sci. Am. Sup.* July 11-5; removal of, from iron work, *The Eng.* Dec. 5-4; painting in encaustic, ancient art of, *Fran. Inst.* Sep.-5; paint mill, white lead, *Sci. Am. Sup.* Dec. 18-6; paints, luminous, *Iron Age*, Oct. 4-3; do. metal, Aug. 13-5; do. for exposed metal surfaces, *Sci. Am. Sup.* Sep. 12-5.
PANAMA, Chamberlain, *Eng. News*, Nov. 3-3. See also CANALS, PANAMA.
PAPER from sawdust, *Eng. News*, Dec. 27-4; hist. of, Bryan, *Sci. Am. Sup.* Mar. 3-3; water-proof, July 24, 31-6; calendering and cutting mach., Bertram, Mar. 5-7; do. *Eng.* Dec. 31-6; hand made, controversy, *Locom.* Dec.-6; Bowker, n. Sep.-7; do. *Harpers*, June-7; do. *Paper world;* water-proof, C. R. Wright, *The Eng.* June 6-4; mills, Esk and Valleyfield, Penicuik, Aug. 5-7.
" NEGOTIABLE, *Iron Age*, July 24-4.
PARIS, bu., people and poverty, *Eng. News*, Jan. 12; pop. stat. Dec. 27-4; Met. Ry. n. Aug. 15; do. and traffic, Haag, Aug. 22; sewage util. Nov. 7-5; st. cleaning, Feb. 5; water and tramway stat., n. July 16-7; Met. Ry. schemes, *Eng.* June 27; exhib. sites, '89, Dec. 5-4; st. cleaning, Jan. 14; as a seaport, Nov. 25-7. See also ENG., MUNIC., PARIS.
PARKS, Yellowstone Nat., U. S. *Sci. Am. Sup.* Oct. 20-3; Jan. 19-6; *Eng.* Oct. 7, 14, 28, Nov. 25-7. See also BOSTON, ETC.
PARTNERSHIP. *Iron Age*, Dec. 4-4.
PATENTS, U. S. office, rep. U. S. *Eng. News*, Sep. 10-7; do. *Mech.* Aug. 25; law of, bk. n. Nov. 24-3; duration, U. S. Apr. 26-4; sys., Am., Perkins June-7; U. S. rep. *Ry. Gaz.* Oct. 16-5; Mansfield, *Ry. & Eng* Feb.-7; English, act '83 and Am. inventors, *Fran. Inst.* Mar.-4
" U. S. office practice, Fowler. *Electric.* June-6; U. S., electric, stat. '86, Feb; sys., U. S., reforms in, Steuart, Mar.-7; law revision, do. *Elec. World*, Dec. 24; do. U. S. Dec. 31-7; office reorganization, U. S., Platt, *Sci. Am. Sup.* Apr. 12-4; U. S. *Eng.* May 20; law, mechan. equivs. Aug. 19-7; English, *Eng.* files, Jan.-3-Dec.-7; do. *The Eng.* files, Jan.-3-Dec.-7; bill, Brit. *The Eng.* Mar. 23; act, English, Dec. 28-3.

PATTERN DESIGN, Day, *Sci. Am. Sup.* Apr. 9-30-7.

PAVEMENTS, standard, spec., U. S., rep. *Eng. News*, Mar. 10, 17; wood, Paris, Sep. 29-3; asphaltum, Feb. 16; composite, Mar. 29; wood, London, Bedell, July 5; do. do. map, Stayton, Nov. 22, 29, Dec. 6, 13; Kerr, July 19; st., Phil., rep. Aug. 9; Kansas City, Dec. 13-4.

" WOOD, cost of, *Eng. News*, Feb. 14; asphalt, Feb. 28; do. vs. wood, May 30; st., St. Louis and Markland, June 6-5; prices, Neb. Feb. 20; relative safety of asphalt and stone, Mar. 13; "Ceramite" as paving material, Gonvy, Mar. 20; tar, Apr. 17; road paving material, Campbell, Apr. 24; paving, Aug. 21; 5th Ave., N. Y. Oct. 2, 9-6; Phil. paving, Jan. 15; st., Sargent. Sep. 24, 24; do. Chicago, Sep. 24-7.

" STREET, *Iron Age*, Dec. 24-5; pavings, June 24-6; wood, in, London, Stayton, *Am. Eng.* June 27-4; asphalt, at Washington, Dec. 10-5; wood and asphalt, Neville, May 13-6; and st. Rys. *San. Eng.* Feb. 19, Mar. 12, Apr. 9, May 21, July 30, Aug. 6-27, Sep. 3, 17, 24, Oct. 1, 8-7; do. N. Y., Stayton, *Eng. & Bu. Rec.* Nov. 12, 20, Dec. 3. 10, 24-7; do. spec., St. Geo., London, Dec. 24-7; do. in London, Haywood, *San. Eng.* Aug. 27-7.

" ASPHALT paving of Berlin, n. *Van Nost.* Oct.-6; st. *Fran. Inst.* Sep-4; do. W. B. Knight, *Sci. Am. Sup.* Feb. 14-5; cement paving, Feb. 27-6; st., discuss., West. Engs. Jan. 29; foot, asphalt and concrete, Strachan, Dec. 31-7; composite, *Eng.* Dec. 14-3; wood, June 6-4; brick, Apr. 29-7; metallic, Wilke's, *The Eng.* Dec. 25-5. See also ENG., MUNIC., London, Paris, etc.

PEN, Mackinnon, writing fountain, *The Eng.* Mar. 27-5.

PENN. industries, *Eng. News*, Oct. 16-6.

PERU, debt, *Eng. News*, July 30-7; *Iron Age*, July 30-5; trade, Jan. 14-6; prog. Mar. 31-7.

PERSPECTIVE, Smith, *Power & Trans.* June, July-7.

PETROLEUM, Am. stat. *Eng. News*, May 31-4; pipe lines, Nat. Transit Co., June 13; do. transport. by, France (naphtha indus. in Caucasus), Sage, Aug. 1-5; Russian vs. Am., n. Nov. 13; Russian, Tarbutt liquid fuel, n. Nov. 20-6; furnaces, *Iron Age*, May 3; exports, Aug. 30; as vapor fuel, Nov. 22-3; Caspian, Oct. 30-4.

" EXPORTS, *Iron Age*, Jan. 8; rock quarry, Alsace, Feb. 12; transport. July 2, Oct. 22-5.

PETROLEUM, oil product, Penn. and N. Y. Nov. 26-**5**; as fuel, Jan. 21; liquid fuea, Jan. 28; do. burners in Russia, Feb. 4; Russian trade, Apr. 1; carrying vessels, Sep. 2; burner, Am. Oct. 21; oil wells, Russian, Nov. 18; Russian pipe line concession, Nov. 25-**6**; refined, exportation, Mar. 24; Russian, Apr. 7; burners, Westphal, Apr. 7; liquid fuel burner, Aerated Fuel Co. Oct. 27-**7**.

" FURNACES, Russia, *Mech.* Apr. 28; as fuel, Dec. 8-**3**; liquid fuel, n. Dec. 5; quarries, Alsace, Germany, Feb; refuse as fuel in locoms., Urquhart, Mar; liquid hydrocarbons as fuel, Abel, Aug.-**5**; products, n. Nov.-**6**; combust. of mineral oils and residues in b. furnaces, D'Allest, *Am. Eng.* Dec. 17—31-**5**.

" ENG., Eteve, *Am. Eng.* Nov. 3; liquid fuel, Tarbutt, Nov. 24, Dec. 1, 8; liquid, Dec. 1-**6**; fuel in Russia, stat. Nov. 9; oil for fuel, Nov. 30-**7**; do. *Ry. Gaz.* Sep. 14-**3**; fuel, July 1-**7**; do. liquid, *Van Nost.* Jan, Apr.-**6**; strs., Nichol, *Ry. & Eng.* Feb; oil for fuel, Aug; Russian, rep. Oct.-**7**; as emergency power for war-ships, *Fran. Inst.* May-**4**; Russian, n. Jan, Mar.-**7**.

" PRODUCTS, and, King, *Sci. Am. Sup.* May 26; burning ap., Lent's, Brandt's, Sep. 22-**3**; indus., Russian, May 31; vaseline manuf. May 31; bitumens, origin of, Peckham, Sep. 6; wells, Dec. 13-**4**; transport., Nat. Transit Co.'s pipe lines, Olean, N. Y. to Brookline, July 11; Am. oil and gas fields, Dewar, July 18-**5**.

" ENG., Spiel's, *Sci. Am. Sup.* Apr. 3; illum., King, Nov. 6; carrying strs., Martell, Nov. 13-**6**; burner, May 7; regions in U. S. and Canada, Redwood, Sep. 10, 17; marine b. for petrol. fuel, Dec. 10; burning ap. for torpedo boats, Dec. 17-**7**; products as related to san. legislation, Peckham *Soc. Arts*, Apr. 23-**5**; oil and nat. gas, meths. of drilling for, Newell, Jan. 7-**6**; 1st oil well, *Locom.* Dec.-**4**.

" LIQUID FUEL, *Eng.* June 22, 29; storage of, Oct. 19-**3**; indus., Russian, Feb. 22, Mar. 7, 21, 28, Apr. 4, 18, May 2, 16; oil wells in Penn. Dec. 19-**4**; storage of, Feb. 13; as fuel, Smith, June 19; transport. July 31; do. Harris, Oct. 9-**5**; eng., Spiel, Feb. 5; iudustries of Europe, Jan. 29, Feb. 12, 26, Mar. 12, 26, Apr. 9; liquid fuel, June 11, 25; carriage of, by sea, July 30; strs. July 30, Nov. 26, Dec. 10; refining and transport. Nov. 12, Dec. 3, 17-**6**.

PETROLEUM burning furs., Saratoff water wks. *The Eng.* Mar. 23; storage, Aug. 10-3; as fuel, at Forth bridge wks. Oct. 3-4; transport. in bulk over sea, strs. July 30; produc., U. S., n. Nov. 5; liquid fuel, Dec. 24-6; eng., Spiel, Jan. 21; transport. of Black sea, June 17; fuel in Russia, Commiss. rep. Aug. 26; fuel, Urquhart, Sep. 16; do. on Thames r. Nov. 11; do. expts., Thwaite, Dec. 9-7.

PHILADELPHIA, travel (rapid transit), Haupt. *Eng. News*, Nov. 8-4; highways imp. Jan. 2; pub. bu's, Oct. 9-6; manuf. industries in '85, *Iron Age*, Jan. 7-6; st. Ry. traffic, '85, n. *Am. Eng.* Mar. 11-6; rapid transit in Haupt, *Ry. Gaz.* May 30-4; geol. of, May, June; water supply, *Fran. Inst.* Apr, July, Nov.-3. See also ENG., MUNIC; WATER WORKS, Phil.

PHILIPPINE ISLANDS, fabrics and industries of, Kneeland, *Soc. Arts*, Jan. 11-3.

PHONOGRAPH, Edison's, *Elec. Rev.* Oct. 22, Nov. 5-7; *Locom.* Nov.-7.

PHOTOGRAPHY, engineering, Humphreys, *Eng. News*, June 14-4; isochromatic, *Iron Age*, July 30-5; subaqueous, Feb. 25-6; upon wood, Feb. 24-7; do. *Mech.* Aug. 4-3; actinism, *Fran. Inst.* May; isochromatic, July; composite, Aug, (Washington) Oct.-5; do. Feb; by lightning flash, Mar; color-sensitive, July, Aug; isoch., Ives, rep. Oct; with phosphorescent substances, Dec.-6; heat, Ives, Mar; flash light, Carbutt, Dec.-7; in medicine, *Electric.* Oct.-3.

" ENAMEL, *Sci. Am. Sup.* Apr. 28; gelatine plates, Farmer, May 12; pictures on glass, Godard, May 12; silver printing, permanent, Bruce, Oct. 13; ap. for taking at regular intervals, Oct. 20-3; on wood, Taylor, Mar. 15; instant. Mar. 29; mounting and coloring photos. in imitation of oil paintings, Nov. 8-4.

" PHOTOS., vitrified, *Sci. Am. Sup.* Jan. 17; non-actinic light for dark room, Mar. 14; intensification of gelatine plates, Spiller, Mar. 25; lantern transparencies, T. N. Armstrong, Apr. 4; develop. imps., Burton, Apr. 18; plates, aids to correct exposure of, Goodwin, June 6; isoch., Ives' proc. June 6-5.

" PHOTOGRAPHER'S conveniences, *Sci. Am. Sup.* Aug. 1; silver printing, Wallace, Sep. 12; cylindrograph, Moessard's (panorama phot.), Sep. 19; lantern slides by contact printing, Nov. 28-5; gelatine emul. ap., H. London, May 15-6.

PHOTOGRAPHY, invisible image, Harrison, *Sci. Am. Sup.* July 24; oxygen and hydrogen lantern reg., Beard, July 24-**6**.

" INSTANT. operation of shutter in, *Sci. Am. Sup.* Sep. 25; chemicals, impurities in, G. M. Jones, Oct. 2; photos. printing wk. Oct. 9; collodio-bromide emul. proc. for lantern slides, J. B. Wellington, Dec. 18-**6**; lantern transparencies, or wet collodion, Jan. 22; of moving objects, Marey, Feb. 5, 12; unboiled emuls., Newburg, Feb. 12, printing lantern pictures by artif. light, Humphrey, Mar. 26; coating paper with gelatine emuls., Burbank, May 21; Perron's ap. June 4-**7**.

" PRINTING proc., Husband, *Sci. Am. Sup.* Aug. 6; formula for develop. of paper negatives, Aug. 20; photo-engraving processes, Sep. 24; amusing, Oct. 8; image, latent, and red and purple chloride, Lea, Oct. 15-29, Nov. 5; collodio-chloride for printing paper, Passavant, Dec. 3; camera bellows, Dec. 24-**7**; plates, sensitiveness of, Pickering, *Soc. Arts*, Apr. 26-**3**; stellar, do. Dec. 23-**6**; in natural colors, Lea, *Locom.* July-**7**; photo-mechan. printing machs., Bolas, *The Eng.* Nov. 7-**4**.

PHOTOMETRY, *Eng.* Jan. 5, 12, 26, Feb. 23, Mar. 16, 30, Apr. 20, 27, May 25, June 8-**3**. See also LIGHT.

PHYSICS See also ELECTRICITY; ENG., MECHAN.; HEAT; LIGHT; SOUND, ETC.

" COMPRESSIBILITY of solids, Spring, *Am. Eng.* Sep. 7-**3**; do. Apr. 4, 11, Aug. 1; matter, kinetic theory of, W. Thomson, Sep. 12, 19, 26-**4**; magnetization, change in length of iron, steel and nickel rods by, Bidwell, *Van Nost.* Nov.-**5**; æther, liminiferous, Wood, Jan; air, physiography, Evans, Jan; electricity, atmos., origin, Gerland, Feb; carb. acid in liquid and solid state, n. May; energy, conservation of, Dixon, June; light, white, standards of, July-**6**; sound radiometer, Dworak, *Electric.* July-**4**; microscopy, elec. illum. in, Schultze, Mar.-**5**.

" HEAT, light and electricity, E. Gray, *Sci. Am. Sup.* Apr. 7; radiant matter spectroscopy, Crookes, July 21; liquid vortex rings, Hart, Sep. 1-**3**; matter, kinetic theory of, W. Thomson, Oct. 25-**4**; gravity, true constant of, Apr. 4; of tenuity, soap bubbles, Sloane, June 27-**5**; atoms and molecules, Sloane, Jan. 23; properties common to fluids and solid metals, Austen, July 17; capillary attraction, W. Thomson, Oct. 9, 16-**6**.

PHYSICS, units, theory of (measurement of magnitude), Szarvady, Aug. 13; flow of solids, or liquefaction by pressure, Hallock, Nov. 5-7.

" FINE rulings on glass and metals, W. A. Rogers, *Soc. Arts*, Dec. 28-2; colors, proper meth. of measuring, Pickering, May 8-4; liquid vortex rings, Hart, *The Eng.* July 20; W. R. Browne, Nov. 23-3; matter, kinetic theory of, W. Thomson, Sep. 5-4; 3d law of motion, W. H. Hudson, Mar. 13, 20; motion, laws of, R. H. Smith, Mar. 27, Apr. 3; do. do. Newton's, Lodge, Apr. 24, May 15; do. do. Lonsley, May 1; n. June 19; pendulum, conical, theory of, Lyon, Dec. 18-5; capill. attraction, W. Thomson, Feb. 26-6.

PIANOFORTE, hist., Hopkins, *Sci. Am. Sup.* May 19-3; action, Chickering, Lowe, *Soc. Arts*, Apr. 26-3; with organ pedals, Wedlake, *The Eng.* Dec. 31-6.

PILES, driving, cutting mach. under water, Clarke, *Eng. News*, Jan. 27-3; do. Apr. 2-7; machs. June 16-3; in Japan, May 10-4; Beckler, Aug. 7-6; *Iron Age*, Apr. 29-6; effic. *Mech.* Nov.-4; mach., large, Cen. R., Ga. Aug.-5; do. *Nat. Car Bu;* Beckler, *Am. Eng.* July 14-6; stm. hammer, Cram's, *San. Eng.* Mar. 12-7; piles bearing power, formulas, *Ry. Gaz.* July 8-7; *The Eng.* May 14, Dec. 17-6. See also BUILDING; ENGINEERING, BUILDING, FOUNDATIONS; HARBOR ENG.

PIPES, iron, fittings, standard, *Iron Age*, July 12; do. and b. tubes, Dec. 20-3; nipple mach. Oct. 21-6; standard. and pipe threads, Mar. 3-7; tapping mach. under press., Debaussaux, France, *Mech.* Jan. 26; lead, strength, Mar. 29-4; joints, hot water, Mar.-5; do. *Am. Arch.*

" STANDARD, and pipe threads, Bond, *Mech.* Dec.-5; wrt. iron, table, Nov.-6; iron, protection from rust, Scott, *Am. Eng.* Jan. 7-6; threads, uniform standard, Mech. Eng. committee rep. Mar. 2, 9; joint, May 25-7; continuous stone, construct. mach., Hamilton's, *San. Eng.* Feb. 8-3; threads, standard, Bond, Nov. 19-5; do. committee rep. Feb. 26; joints for nat. gas, Sep. 24-7.

" THREADS, standard, *Ry. & Eng.* Apr.-7; lead, making mach. *Sci. Am. Sup.* Dec. 1-3; cast iron, large, manuf., Widnes foundry, Jan. 12-4; hose, flow of water through, E. B. Weston, Jan. 3-5; sheet iron, elbowing mach. Mar. 12-7.

PIPES, sheet metal, *Eng.* July 16; hydr. testing mach., Kennedy's, Dec. 24-**6**; fittings manuf. in U. S., Forbes, Feb. 25; threads, standard, Apr. 15-**7**; lead, mach., Weems, eng. *The Eng.* Oct. 12-**3**; copper, expts., Sinclair, Dec. 23-**7**; do. do. *Eng.* Dec. 23-**7**. See also PLUMBING; SCREW THREADS; STEAM PIPES; WATER WORKS, ETC.

PITTSBURG, map, *Iron Age*, Feb. 11-**6**; industries, Sep. 20-**3**; do. *Eng.* Mar. 26-**6**; Jan. 7-**7**.

PLANER TABLES. *Mech.* Feb. 2-**4**.

PLAYFAIR, LYON, por. *Sci. Am. Sup.* Oct. 17-**5**.

PLANING MACH., Wilkinson, eng. *The Eng.* Apr. 11-**4**; double cutter, Buckton, Apr. 8-**7**.

PLANT ANAL. as an applied sci., Abbott, *Sci. Am. Sup.* Nov. 12-**7**.

PLUMBING, spec. *San. Eng.* Jan. 11; London res. Feb. 22; Met. opera h., N. Y. Dec. 20; Am. practice, Dec. 6, 27; English do. Sep. 27, Oct. 4, 25, Nov. 1, 15–29, Dec. 6, 20-**3**; do. Jan. 3, 17, 31, Feb. 28, Mar. 13, 20, Apr. 3, 24, May 8, 15, 29, June 26, July 24, Aug. 14, Sep. 18, Oct. 9, 23, Nov. 20, Dec. 25-**4**.

" AM. PRACTICE, Jan. 3, 31, Feb. 14; and san. features in Com. Vanderbilt's stable, May 1; exam. paper, June 26; res., H. G. Marquand, N, Y. June 7, 14, July 3–31, Aug. 7–28; and plumbers, July 10; a Boston res. July 17; Nat. Conven. pro. July 3, 10, 31; and water supply, H. H. Cook's res. Nov. 13, 27-**4**; Feb. 12; Mar. 26; English practice, Jan. 1, 8, 29, Feb. 19, Mar. 5, Apr. 16, May 7, 21, June 4, 11, July 16, Aug. 13, 27, Sep. 17, Oct. 8, 29, Nov. 12, 26, Dec. 10, 31; Hemenway bu., Boston, Mar. 12; res., F. L. Higginson, Boston, May 28; Nat. Assoc. pro. July 2; in Newport res. Oct. 1; res., Geo. Lewis, N. Y. Dec. 24-**5**.

" ENGLISH PRACTICE, *San. Eng.* Jan. 14, 21, Mar. 11, Apr. 8, June 3, July 1, 29, Aug. 26, Sep. 23, Oct. 14, 23, Nov. 13, Dec. 18; specs. for Syracuse, Feb. 4; requirements for Milwaukee, Feb. 11; do. and registratton of in Phil. Feb. 18; do. Denver, May 20-**6**.

" NAT. ASSOC. Master plumbers, pro. July 1; work, extras in, July 22; in tenement, N. Y. Aug. 5; Chic. apprenticeship sys. Aug. 19; appliances for water waste prevention, Coyne, Sep. 9; apprenticeship in N. Y. Sep. 16; of West Middle school, Hartford, Sep. 23; in 12th regt. armory, N. Y. city, Sep. 30, Oct. 7; why a plumber needs a helper, Scott, Sep. 30; in Phil. Nov. 20; wk., Hudson r. State Hos. Dec. 25-**6**.

PLUMBING, English practice, *San Eng.* Jan. 8, Sep. 3, 17, Oct. 1; catechism of N. Y. trade schools, Jan. 8, Feb. 5–19, Mar. 12, 19, Apr. 2, 9, 30, May 7; requirements, Rochester, N. Y. Jan. 22; Nat. Assoc. Plumbers, pro. June 25, July 2; rules, N. Y. Aug. 27-**7**; *Eng. & Bu. Rec.* Oct. 22; N. Y. Nov. 12; Am. Nov. 19, Dec. 3; in N. Y. R. R. Men's bu., N. Y. Dec. 24-**7**.

PNEUMATIC, transmission between London and Paris, Bulier sys. *Eng. News*, Mar. 28-**5**; pipes, Equit. Life Ins. bu., N. Y. *Eng. & Bu. Rec.* Nov. 12-**7**; despatch tube sys., electro, McLauthlin's, *Elec. World*, Apr. 16-**7**; tubes, *Sci. Am. Sup.* Apr. 10-**6**.

POLE ROADS and railways, locom., Tanner & Delaney, *Iron Age*, Mar. 25-**6**; locoms. and construct. *Am. Eng.* Apr. 1-**6**; locom., Adams & Price, *Ry. Gaz.* Feb. 19; do. Cowles, Apr. 16-**6**; and locoms. *Sci. Am. Sup.* May 15-**6**; locom. *The Eng.* Mar. 12-**6**.

PORCELAIN, casting, *Iron Age*, July 16-**5**; cyl. mill, Weymann's, *Sci. Am. Sup.* Mar. 24-**3**; moulding ap., Lauth, Apr. 11-**5**.

PORTABLE STEAM BOILERS AND ENGINES, b., Colby, *Iron Age*, Mar. 26-**5**; eng., Erie Eng. wks. Apr. 22-**6**; semi-port. eng., 50 H. P. comp., Ruston, *Mech.* Nov.-**4**; eng. test, *Am. Eng.* Oct. 15-**5**; engs., comp., Hornsby, Marshall, *Sci. Am. Sup.* Mar. 14-**5**; do. Turner, *Eng.* Aug. 3; semi-port. and traction, Dec. 14; do. Lane & Bodley, Dec. 21-**3**; eng., Mather, Mar. 27; semi-port. engs., Robey, Nov. 13-**5**; pumping eng., Webber, Dec. 24-**6**.

" ENG., Turner's, *The Eng.* July 27-**3**; semi-port. comp. eng., Burrell, eng. Mar. 14; do. 50 H. P., Ruston, spec. July 11; do. do. Robey, Sep. 26; engs. Dec. 12-**4**; do. Mather's, May 8; semi-port. eng., Robey's, with Richardson's elec. reg. July 17-**5**; eng., Budapest exhib. Feb. 5; semi-port. eng., 40 H. P., Robey, Edinb. exhib. Aug. 20; do. do. comp., trial of, Davey, eng. Nov. 26-**6**; eng., comp., McLaren, eng. Aug. 19-**7**.

POSTAL SERVICE of world, hist. *Sci. Am. Sup.* Mar. 19, 26-**7**.

POST OFFICE, U. S., in time of Washington, McMaster, *Sci. Am. Sup.* Oct. 3-**5**.

POWER, transmiss., hydr., London, *Eng. News*, Feb. 6; distrib. by compressed air at Birmingham, England, Oct. 16-**6**; transmiss. and heating, stm. and hot water, comparative value, Emery, *Iron Age*, July 21, 28-**7**.

POWER transmiss., long dist., Reuleaux, *Ry. Gaz.* June 25-**6**; do. and storing, E. Thompson, *Elec. World*, Jan. 24-**5**.

" DISTRIB. to h's by rarefied air, Hirn's telodynamic cables, Chretien, *Sci. Am. Sup.* Oct. 10; accumulatory, Dohis', Dec. 5-**5**; measurement of, Suplee, *Power and Trans.* June–Aug.-**6**; and motion, Atkins, July-**7**; distrib., hydr. *Eng.* Aug. 1-**4**; transmiss., frictional driving gear, Ewing, Mar. 12; do. by gearing, Mar. 19, June 11; dist. by compressed air, at Birmingham, Oct. 1-**6**.

" METER, Ashton, *Mech.* Oct.-**5**; *Eng.* Jan. 1-**6**.

PREECE, WM. H., por. *Elec. World*, May 14-**7**; *Sci. Am. Sup.* July 16-**7**.

PRECIOUS STONES, cameo cutting, Marsh, *Sci. Am. Sup.* Mar. 5; and gems, Kunz, Dec. 31-**7**; in U. S., do. *Harper's M.* Dec.-**7**.

PRESS, hydr., 4,000-ton forging, *Iron Age*, May 27; drop, Nov. 18-**6**; power, double crank, Ferracute Mech. Co. *Mech.* Oct. 6; drop, press. attainable by, Thurston, Nov. 24-**3**; do. do. *Van Nost.* Jan.-**4**; rotary, Fritsche, *Mech.* Jan. 5; hydr., friction of leather collars in, expts., Hick, July-**4**; power, problems, O. Smith, Dec.-**7**; do. do. *Am. Eng.* Nov. 30-**7**.

" DROP, press. by, *Fran. Inst.* Dec.-**3**; presses, Socius, Lebee's, Poizot's, Champonnois', for beet roots, etc. *Sci. Am. Sup.* Aug. 29-**5**; stamping, Seymour's differential vernier, *Eng.* Oct. 19-**3**; do. do. *Am. Mach*; embossing, James', *The Eng.* May 9-**4**; letter copying, Capel's, Feb. 26-**6**. See also PRINTING PRESSES.

PRICES, products, rise and fall of, *Iron Age*, Jan. 28-**6**.

PRINTING AND PRESSES, 2-rev., Potter, *Iron Age*, Jan. 17-**4**; do. *Mech.* Jan. 12-**4**; type setting by elec. *Elec. World*, Feb. 20-**6**; Marcilly's copper plate, *Sci. Am. Sup.* Oct. 27-**3**; proc., autographic, chemico-mechan. May 24; Marinoni's rotary, July 26-**4**; centenary of London Times, Feb. 21-**5**.

" PLATES or engravings by etching, Gillot proc. Sep. 4-**6**; Feister; Apr. 23-**7**; produc. 60,000 copies per hour, *Locom.* Sep.-**7**; do. *Paper World*; mach. *Eng.* May 13-**7**; do. *The Eng.* Apr. 22-**7**. See also TYPE COMPOSING MACHS.

PROPELLER. See MARINE PROPELLER.

PROVIDENCE, R. I., city rep. *Eng. News*, Jan. 19-**4**; pub. wks. Apr. 10-**6**. See also ENG., MUNIC., PROVIDENCE.

PUBLIC WORKS dept., U. S., W. F. Smith, *Eng. News*, June 11-**7**; *Forum*.

PULLEY, steel, Fulton, *Mech.* Feb. 2-**4**; divided, Cross, July, and wagon wheel lub. devices, Sonderling, Oct.-**5**; Fulton's, *Am. Eng.* Feb. 1-**4**; wooden split, July 28-**6**; friction, Feb. 16-**7**; cone, *Fran. Inst.* Feb.-**3**; telescope, Christie, *Elec. Rev.* Sep. 18-**6**; wooden, *Elec. World*, Aug. 16; friction clutch, Frisbie's, Dec. 13-**4**; centrif. friction, Weston's, *The Eng.* Nov. 6-**5**; friction, Oldham, Oct. 29-**6**.

PULLMAN, Ill. *Mech.* June 28-**4**; from a state med. point of view, De Wolf, *San. Eng.* Apr. 17-**4**; expt. June 25; casino and parsonage, July 16-**5**; *Ry. Gaz.* Oct. 29-**6**; *Sci. Am. Sup.* Mar. 22-**4**.

PULVERISERS, centrif., Waring, *Mech.* Feb.-**6**; mach., Tischer, *Sci. Am. Sup.* Oct. 30-**6**; Walker's, *The Eng.* Aug. 1; Wood's grinding mill and separator for hard substances, Dec. 26-**4**; Sheppard's crushing mill, May 8; Griffin's, July 24-**5**; mach. Sep. 10-**6**; "Devil" disintegrator, Hardy Pick Co. Nov. 4-**7**.

PUMPING ENGINES, Holly-Gaskill, test, rep. *Eng. News*, July 14, Sep. 1; and testing, specs., Buffalo, Oct. 6-**3**; Holly-Gaskill, Saratoga, N. Y. Apr. 26; pumping by wire rope transmiss. Aug. 30; Davidson, test, Brooklyn water wks. Nov. 8-**4**; and mach. for water wks., Pond, May 30; comp. condensing, Worthington, June 13; pumping hot water, Coles, June 27-**5**.

" ENGS., Worthington, New Bedford, Mass. *Eng. News*, Jan. 26; pumping dredge, Jan. 30; and b's, specs., St. Louis water wks. Aug. 7; stm., selection of, Wolff, Sep. 25; Worthington, high duty, expts., Mair, Nov. 6-**6** pumping plant, early Am., Phil. Apr. 16; high service motor, Burlington, Vt., Parker, Oct. 1-**7**.

" ENGS., Am., econ. and duty of, *Iron Age*, Feb. 26-**5**; water pumping, July 15-**6**; Rider hot air, N. Y. Aug. 4; expansive working in, Davey, Oct. 13-**7**; and winding mach. of anthracite coal regions, Green, *Mech.* June 30-**3**; power regenerator, Bochkoltz, Apr; Leavitt, Boston Main Drainage wks. Dec.-**5**; comp. Gaskill, June; Wolf, Aug.-**6**.

" ENG. performance, n. *Am. Eng.* Apr. 4; Porter, June 6; pumping hot water, Cole's, Aug. 22; mach. of Richmond, Va. Water wks. Dec. 26-**4**; Reynold's, at Allegheny, Pa. Mar. 6; Gaskill, duty, table, Apr. 10; mach. for water wks., Pond, June 5; comp. condensing, Knowles, Nov. 5-**5**.

PUMPING ENGS., Leavitt, Boston Main Drainage wks. *San. Eng.* Mar. 27-4; Worthington, Apr. 1-6; do. Buffalo, N. Y. *Van Nost.* Apr, July; Gaskill, Saratoga, N. Y., Hill, Oct.-3; Reynolds, do. Feb.-5; Gaskill, test, do. *Ry. & Eng.* Jan, Feb.-7; do. Saratoga Springs water supply, *Sci. Am. Sup.* Nov. 29; non-condensing, Pildacre colliery, Nov. 29-4; mach., mine, Leavitt, June 6-5; do. do. addr. July 31-6.

" ENGS., hor., Hayward Tyler, *Eng.* Jan. 5-3; Gaskill, Saratoga, N. Y. Mar. 7; May 2; friction loss by, May 23; comp., Eastbourne water wks. Oct. 3, 24, Nov. 21' Dec. 5-4.

" ENGS., mach., Bosisio, Milan, *Eng.* Mar. 6, 20; comp., Duncan, Inv's exhib. May 1; do. Buda-Pesth water wks. May 8, 22, June 5; do. Whitacre, Birmingham water wks., Gray, July 3, 17, Aug. 14, Sep. 11, 25; do. condensing, Worthington, Nat. Tran. Co. pipe lines, July 31; centrif., 30-in., Gwynne, Aug. 7; mach. Inv's exhib. Aug. 28; centrif. Aug. 28; comp., Northwich water wks., Wolstenholme, Sep. 25-5.

" ENGS., Reynolds, Allegh. City, Pa. *Eng.* Jan. 8, 22; regulator, Mason, Apr. 9; comp., high press., Millwall docks, May 14; Worthington, Aug. 20; do. high duty, Oct. 1; comp., Yokohama, Sep. 24; Sydney water wks. Dec. 3-6; centrif., Khatetbeh, Egypt, Farcot, Jan. 28; Lincoln water wks., Teague, Mar. 4; underground, Denby colliery, Thornewill, Mar. 25; Prague water wks. Sep. 23; stm., Grendon, Oct. 28; comp., at Watford, Oct. 28-7.

" ENGS., comp., trial, *The Eng.* May 4; do. tandem, St. Albans water wks. Aug. 17, 24, 24; Bascoup collieries, Sep. 7, 14-3; hydr., Marple water wks., Hathorn, Mar. 7; do. comp., Deptford, May 9; hor., Bradley, Oct. 17-4.

" ENGS., mach., high press., Buenos Ayres port, Tyler, eng. *The Eng.* Mar. 6, 13; Remscheid water wks. Apr. 10; hydr., Drysdale, eng. Apr. 24; Cornish, Davey's differential valve gear, Aug. 21; hydr. high press., Fielding, eng. Sep. 25-5; comp., Blake, July 16, 23; do. Malta water wks. July 23; beam, Middlesex water wks. July 23, 30-6.

" ENGS., Alexandra docks, *The Eng.* Sep. 3; comp., Stockton water wks. Sep. 3, 3; underground, Hebburn colliery, Oct. 1; mach., Pearn's, Oct. 15; Amsterdam water wks. Nov. 5–19-6; Burton-on-Trent sewage wks., Gunson, Feb. 25; duplex, Fielding, June 10; comp., Hampton, July 1, 8; vertical rotative, July 22, 22-7.

PUMPING ENGS., vertical rotative, Sontwack water Co. *The Eng.* July 22, 29; Indian State Rys. Aug. 19; differential, Umaria colliery, Aug. 19; mach., Widnes water wks, Aug. 26-7.

PUMPS, centrif., large, *Iron Age*, Aug. 21-4; without valves, Reis, Antwerp, June 25-5; centrif., Lawrence Mach. Co. Mar. 18; do. vs. reciprocating, July 8-6; constant current, Baillet, *Mech.* Dec. 29-3; ratory, piston, Peck, Jan. 5; do. wall, Constantin, France, Sep.-4; without valves, Reis, Antwerp, June; centrif., English, July-5; Sigaudy, Mar.-6; centrif., effics., Webber, Dec; flanges divergencies, Sanguinetti, Dec.-7.

" SAND, Booth's, *Am. Eng.* Sep. 12-4; centrif., effic., table, Apr. 17; do. Lawrence Mach. Co. Dec. 10-5; power, Webber differential, Apr. 6; flange diam. divergs., Sanguinetti, Nov. 23; centrif. Dec. 7-7; press., reg., Mason, *Ry. Gaz.* Sep. 2-7; elec., Edgerton, *Elec. Rev.* Oct. 22-7; hydrodynamic *Sci. Am. Sup.* Dec. 11-6; valve, Jan. 15-7.

" CENTRIF., expts., West Surrey water wks. *Eng.* Feb. 15-4; hydr., Moore, Feb. 5; centrif., and hydr. propulsion, June 18; centrif., Wade, Dec. 3-6; slurry, Taylor, July 1; mercurial air, S. Thompson, Nov. 25-7; Clyde, *The Eng.* July 20; revolving piston, Peck's, Nov. 2-3; centrif., Tilbury docks, Simpson, Dec. 12-4; Scott's, June 12; slurry, Beasley's, Dec. 18-5; hydr., Johnston's, Dec. 10-6; Whittlesea mere, Sep. 2; Haarlem lake, Oct. 21-7. See also DRAINAGE; WATER WORKS.

PUNCHING and milling mach., Nicholson, Providence, *Iron Age*, Sep. 22-7; holes in soft steel, Guerhard, *Sci. Am. Sup.* Jan. 24-5.

PYRAMIDS, great, of Gizeh, *Eng. News*, Mar. 21-5; do. metrology of, Totten, *Van Nost.* Sep; and Lake Moeris, Whitehouse, Nov.-4; builders, do. June-5; the great, *Sci. Am. Sup.* Apr. 18-5.

PYROMETERS, *Iron Age*, Sep. 4-4; Saintignon, Nov. 12-5; Frew, Feb. 4-6; Browne, *Mech.* Feb; Saintignon, Nov.-5; Boulier's, *Sci. Am. Sup.* May10, July 12; Oct. 11; Ericsson's solar, Oct. 11-4; Saintignon's, Oct. 17-5; do. *Eng.* Sep. 4-5; Frew, Jan. 8-6.

QUARRYING and stone dressing mach., Crump, *Eng.* Feb. 12-6.

QUARRIES, marble, Vt. *Mech.* Sep. 15, 29-3.

QUARRIES, granite, Merrill, *Sci. Am. Sup.* Jan. 22, 29-7; grindstone, *Eng.* Oct. 14-7; elec. blasting and lighting, *The Eng.* June 6-4.

QUARTZ, *Iron Age*, Aug. 30-3; crushing mill, Globe, *The Eng.* July 8-7.

QUEENSLAND, *Eng.* Nov. 19-6.

RAG ENGINE, ENGLISH, *Iron Age*, Sep. 17-5.

RAIL, 80-lb. *Iron Age*, Feb. 5-5; 110-lb. Belgian, *Eng. News*, May 21-7; angle bars, broken, *Ry. Gaz.* Mar. 6-5; buckling from tight joints, Greenhill, Aug. 5-7; do. *The Eng*; cambering arr., Seaman, *Iron Age*, May 24-3; cleaner, stm., Prosser's, *The Eng.* July 8-7; creeping on St. Louis bridge, Johnson, *Eng. News*, Jan. 3-5; do. *Ry. Gaz.* Jan. 2-5; exports, Brit. May 25-3; fastening, Davies' sys. *Sci. Am. Sup.* Jan. 9-6; fishplate, angle, invention of, *Ry. Gaz.*, May 1-5; rolling mill, Parkes, *Ry. & Eng.* Jan.-7; flange, worn, Lehigh Val. R. *Ry. Gaz.* Feb. 18-7; heads, form of, June 18-6; and wheel gauges, Snow, Feb. 22, Mar. 21-4.

" JOINT, breaks, Becker, *Eng. News*, Mar. 21-5; bevelled, Fisher, *Ry. Gaz.* Oct. 1-6; diagonal, Sayre, Apr. 27; Gibbon, Nov. 9-3; nut lock, Houston & Tex. Aug. 1; do. standard, Morgan, Louis. & Tex. Aug. 22-4; do. Am. practice, Jan. 9-5; tests, May 18-3; do. sham, May 2-4; rails and sleepers, Sandberg, *Eng. News*, Mar. 20-6.

" JOINTS, *Ry. Gaz.* Aug. 17-3; Feb. 5-6; boltless, expts., Gibbons, *The Eng.* Mar. 7-4; broken, *Ry. Gaz.* Jan. 30, Feb. 6, 20-5; expts., Hanks, April 2; Fisher, Apr. 23; Mansfield, Mar. 19-6; standard, Chic. Mil. & St. P. Mar. 25-7; Mich. Cen. May 1-5; N. Y. West Shore & B. *Sci. Am. Sup.* July 28-3; and steel rails, Sandberg, Feb. 12-6; why they break, Apr. 3, June 26, Nov. 6-5.

" MILL, Edgar Thomson, Pittsburg, *Iron Age*, July 1-6; engs., *The Eng.* Nov. 30-3; and cogging mill, *Sci. Am. Sup.* June 30-3; engs., Davy, *Iron Age*, Nov. 5-5; Dowler's Iron wks., Leeds, Kitson, *Mech.* Feb.-5, *Eng.* Jan. 2, 9-5; engs., Wendel, June 15-3.

" POST bearing plates, *Ry. Gaz.* Sep. 30-7; production, *Iron Age*, Feb. 19-5; do. and consump. *Ry. Gaz.* Feb. 19-6; U. S., '82, *Iron Age*, Feb. 22; table; June 21-3; do. Mar. 6-4; do. '83, *Locom.* Apr.-4; do. steel, *Ry. Gaz.* Apr. 23-6; rolling, and Tees, power expts. *Iron Age*, July 9-5.

RAIL section, 100-lb. *Ry. Gaz.* June 25, 25-6; and fishplate, standard, N. Y., N. H. and Hart. Sep. 9-7; and joint, track gauge, Forney, Apr. 11-4; heaviest, N. Y. Cen. Jan. 16-5; standard, Chic. Mil. & St. P. *Eng. News*, June 25-7; do. W. R. Jones, *Am. Eng.* June 19, 26-5; do. Penn. R. *Eng. News*, Aug. 13-7; do. Prov. & Worcester, Mar. 19-7.

" SECTIONS, *Nat. Car Bu.* June-5; heavy, Sayre, *Ry. Gaz.* Mar. 18-7; Mattes, Apr. 8, 15, June 3, 24-7; Penn. R. *Eng. News*, Sep. 29-3; Sandberg, *Ry. Gaz.* May 13-7; and splice, standard, Bost. & Albany, Mar. 4-7; standard, *Ry. & Eng.* May 7; do. Mas. Car Builders', *Ry. Gaz.* Mar. 27-5; symetry, *Ry. Gaz.* Nov. 28-4; and tire, Apr. 6-3; do. *The Eng.* Mar. 2-3; Tratman, *Nat. Car Bu.* Aug.-5; and wheel, standards, Prov. & Worcester, *Ry. Gaz.* Mar. 12-6; worn, *Eng. News*, May 14-7.

" TESTING in Russia, *Eng. News*, Nov. 28-5; *Am. Eng.* Dec. 10-5; *Van Nost.* May-6.

" TRADE in U. S. *Eng. News*, June 20-5.

" WEAR, Germany and France, *Ry. Gaz.* Aug. 27-6; web, thickness, expts., Von Weber, Apr. 15-7; and wheel for common roads, *The Eng.* Feb. 2-3.

RAILS, and ballast, Am. practice, *Ry. Gaz.* Jan. 16; chem. composition of bad, July 31-5; English vs. Am. *Eng. News*, Dec. 19-5; and fastenings, Danish State Rys. *The Eng.* Mar. 13 5; forms, *Eng. News*, Feb. 26-7; life of, foreign, *Ry. Gaz.* May 6-7; light, Mar. 13-5; splice bar breakage, June 12-5; spliced oint, Lightfoot, Nov. 4-7; spring, Olmstead, *Ry. & Eng.* Aug.-7.

" STEEL, *Iron Age*, Aug. 7-4; do. *Ry. Gaz.* Nov. 25-7; consumption, Jan. 27-7; do. territorially, Dec. 9-6; on continent, *Eng.* May 21-6; cost, *Eng. News*, Nov. 8-4; do. *Iron Age*, Oct. 30-4; durability, *Van Nost.* July-6; do. *Iron Age*; first Am., Durfee, *Mech.* Sep. 15-3; and iron, prices, *Iron Age*, Feb. 24-7; in Russia, Aug. 5-6; tensile strength, July 1-6; do., Hanks, *Ry. Gaz.* June 25-6; wear of, *Iron Age*, Oct. 9-4; worn, *Eng. News*, Oct. 8-7; do. Penn. R. *Ry. Gaz.* Sep.-3; do. Manhattan elevated, Dec. 17-6.

" PRICES, *Ry. Gaz.* Oct. 5-3; and track labor, July 10-5; production and consump. *Iron Age*, Feb. 25-6; wear of, *Am. Eng.* May 16-4.

RAILROAD ACCIDENTS, U. S. See *Ry. Gaz.* files each month; '82, *Ry. Gaz.* Feb. 16-**3**; '84, nature and causes for 12 years, table, Feb. 13-**5**; *The Eng.* July 23-**6**; Mar. 18, Apr. 1-**7**; bridge, Canadian Pac. *Eng. News.* Sep. 3-**7**; bridge abutments washed out, Grand Trunk, Apr. 30-**7**; Ind. & St. Louis. *Ry. Gaz.* Sep. 14-**3**.

" ACCIDENTS, Chatworth bridge, *Eng. News*, Aug. 20-**7**; do. as seen through French spectacles, Sep. 17-**7**; do. *The Eng.* Sep. 9-**7**; collision, *Eng. News*, Apr. 9-**7**; derailment, remarkable, Chic. St. L. & Pitts. *Ry. Gaz.* May 22-**5**; derailments, influence of earth's rotation on, Randolph, *Van Nost.* Feb.-**3**; at Donnton, *The Eng.* Aug. 15-**4**; dynamics, question of, *Eng. News*, May 14-**7**; earthquakes and tangents, So. Carolina R. *Ry. Gaz.* Oct. 29-**6**.

" ACCIDENTS, English, Doncaster, map, *Eng. News*, Oct. 1-**7**; do. *Ry. Gaz.* Oct. 26-**3**; *Ry. & Eng.* Jan, Oct, Dec.-**7**; Forest Hills, (Bussey bridge; Roslindale), Bost. & Prov. *Eng. News*, Mar. 19, 26, Apr. 2, 9, 23, 30, May 21-**7**; do. *Ry. Gaz.* Mar. 18, 25-**7**; do. rep. *Ry. & Eng.* June-**7**; Fredonia, N. Y. *Ry. Gaz.* Feb. 11-**7**; Fribourg, Switz. *Sci. Am. Sup.* Jan. 6-**3**.

" ACCIDENTS, German, *Ry. Gaz.* Apr. 6-**3**; Jan. 9-**5**; bridge, Glens Falls, rep. Nov. 30-**3**; an instructive, Havre de Grace, P. W. & B., Penn. R. *Eng. News*, June 25-**7**; landslide, N. Y. Cen. *Eng. News*, Apr. 23-**7**; Mass., '83, *Ry. Gaz.* Nov. 23-**3**; Monte Carlo, Nov. 5-**6**; Penistone, *Eng.* July 25-**4** etc; Portadown, *The Eng.* Dec. 17-**6**.

" ACCIDENTS, Republic, O. *Ry. Gaz.* Jan. 14-**7**; Silver Creek, Sep. 17, 24-**6**; do. *Frank Leslie's*, Sep. 23-**6**; track, safeguards against. *Eng. News*, Feb. 12, 26-**7**; train, for 13 years, table, *Ry. Gaz* Feb. 12-**6**; West Deerfield, Apr. 16-**6**; do. Mass. Com. rep. May 28-**6**; Woodstock, *Eng. News*, Feb. 12-**7**.

" APPLIANCES, Chicago exhib. *Eng. News*, June 9-**3**; *Ry. Gaz.* May 25, June 8, 22, 29-**3**; *Iron Age*, July 5-19-**3**; *The Eng.* Aug. 10-31, Sep. 14, Oct. 12, Nov. 16, Dec. 7, 28-**3**; Jan. 18, Feb. 1, Mar. 14, July 11, Aug. 29, Sep. 26, 26-**4**.

" ACCOUNTS, applying net earnings to construction, *Ry. Gaz.* Apr. 25-**4**; Goodwin, Mar. 20-**5**; real estate records, Nov. 28-**4**.

RAILROAD BRACKET GIRDER, N. Y. & Buf. *The Eng.* June 8-3.

" BRAKES, and coupler reports, *Eng. News*, July 2-7; Am. & locom. *Ry. Gaz.* Feb. 19; Bavaria, July 2; continuous, aut. in Europe, June 4-6, Aug. 12-7; *Mech.* Jan.-5; *Eng.* Sep. 25-5, Oct. 29-5; *The Eng.* May 11-3; returns, Sep. 25-5; diagram ap. for, Kapteyn, *Eng.* Mar. 25-7; Am. Brake Co., trials, *Ry. Gaz*, July 31-5; recording ap. Sep. 10-6.

" BRAKES, Burlington trials, *Ry. Gaz.* July 23, 30, Aug. 6–27, Sep. 10, 24, Oct. 1, 22, 29, Nov. 12-6, May 13, 20, 20, 27, June 10, 17, Sep. 23-7. See also R. BRAKES, FRT. TRAIN, WESTINGHOUSE; aut. electro-air, Carpenter, *Ry. Gaz.* May 20-7; Eames valve, Oct. 15-6, May 27-7; elec., Achard, Aug. 5-7.

" BRAKES, FREIGHT TRAIN, aut., trials, Burlington, *Eng. News*, May 21, 28, July 9, Sep. 24, Oct. 1-7; do. *Ry. Review*, May 21-7; train. *Ry. Gaz.* Mar. 30-3, Dec. 4-5, May 7, 28-6, June 10, 17, July 1-7; do. *Ry & Eng.* July-7; elec., Park, Jan. 7-7; do. *Ry. & Eng.* Feb.-7; car, Wilde's aut. *Sci. Am. Sup.* Oct. 27-3.

" BRAKES, gear, *Ry. Gaz.* Nov.9-3; German friction stop block, Mar. 5-6; hydr. fan, *Eng.* June 1-3; interchangeable, aut. Feb. 11-7; do. Grt. East. Ry. *The Eng.* Feb. 18-7; at Inv's exhib. Apr. 2-6; Kampfe, *Elec.* July-4; Loughridge, *Ry. Gaz.* Aug. 26-7; Mallinckrodt, Dec. 19-4.

" BRAKES, pipe coupling, metallic, Kapteyn, *Eng.* June 3-7; power reg., Natchez & Col. R., Jackson, *Ry. Gaz.* July 22-7; screw, Laufman, Jan. 16, shoe, Oct. 30-5; do. Banning, June 8-3; do. Ross. Aug 15-4; do. Lappin, *Iron Age*, Jan. 27-7; slack, question of, *Ry. Gaz.* Aug. 20, 27, Sep. 3-6.

" BRAKES, Tanner case, hist. *Ry. Gaz.* Jan. 19-3; tell tale, Lancas. & York. Ry. *The Eng.* Aug. 8-4; tolls, bridge, Canada So. *Ry. Gaz.* Jan. 12-3; train resist. tests, Burlington, *Eng. News*, June 25-7; do. tests, *Ry. Gaz.* May 15–29, July 31-5; do. July 2, 23, Sep. 10, 24, Oct. 1, 22, 29, Nov. 12-6, do. June 3-7; do. test ap., Berlin, Mar. 4-7.

" BRAKES, VACUUM, aut., London, *Sci. Am. Sup.* Jan. 9-6; *The Eng.* Oct. 16, 16-5; Grt. West. Ry. Apr. 27-3; Lancas. & York. Ry. Dec. 7-3.

" BRAKES, WESTINGHOUSE, *Ry. Gaz.* Sep. 24-6; elec. air valve, June 3; expts., Galton, June 10, 10-7; instructions for working, Jan. 12-3; at Inv's exhib. *The Eng.* Aug. 21-5.

RAILROAD BRAKES, WESTINGHOUSE, hose, *Ry. Gaz.* Jan. 25-4; No. Eastern Ry. Aug. 8-4; *Eng*; *The Eng*; tests, *Eng. News*, Nov. 26, 26-7; *Ry. Gaz.* Oct. 21, Nov. 11, 11, 25, Dec. 2-7; *Electric.* Dec.-7; *Eng.* Jan. 5, Oct. 12, 19-3; Feb. 15, July 18, Oct, 31-4; May 1-5; Dec. 9-7; in U. S. *The Eng.* June 10-7; air, wks. *Ry. Gaz.* May 23, June 13, July 18-4; do. May 21-6.

" BRIDGES, removable, *Iron Age*, Aug. 12-6; viaducts of world, Oct. 18-3. See also BRIDGES.

" BUILDING, early, objections to, *Iron Age*, Mar. 29-3; irreguity of, Kent, *Eng. News*, Sep. 27-4; rapid, Manitoba, Mont. *Iron Age*, Nov. 3-7; do. *San. Eng.* June 4-7; stat. *Iron Age*, Sep. 18-4.

" CAPITALIZATION, *Ry. Gaz.* Aug. 26-7.

" CAR, baggage, mail and express, standard, Pitts. Cin. & St. L., Wall, *Ry. Gaz.* Oct. 9-5.

" CAR Builders Assoc., master, pro. *Ry. Gaz.* Apr. 13, May 4, 18, June 15, 22-3; June 13, 20-4; June 12, 19-5; Jan. 11, 18-6; June 17, 24-7.

" CAR Co., Pullman Palace, rep. *Ry. Gaz.* Oct. 26-3.

" CAR COUPLERS, *Ry Gaz.* Dec. 5-4; Master Car Builders', discuss. June 29-5; Mar. 5, 12, June 25, July 2-6; Shinn committee rep. Dec. 9-7; 42 illus. *Sci. Am. Sup.* Oct. 10-5; S. W. Robinson, May 8-6. in vertical plane, *Ry. Gaz.* Jan. 29; Ames aut. June 5, Oct. 2-5; Aug. 27-6; Archer, Oct. 2-5; Arkman, Barnes, May 28-6; attach. tender, Colby, July 4-4; aut. June 5-5; M. C. B. rep. *Ry. & Eng.* July-7; do. Avery aut., C. B. Emerson, *Soc. Arts*, Apr. 26-3.

" CAR COUPLERS, Cowell, *Ry. Gaz.* Oct. 2; Dowling, Oct. 2-5; do. Aug. 19-7; Evans, Nov. 7-4; freight, Oct. 2-5; do. McKeen, May 28; do. Ames, Aug. 27-6; do. M. C. B. rep. June 17-7; and frt. train brakes, Iowa R. Coms. rep. *Ry. & Eng.* June-7; frt., aut., *Sci. Am. Sup.* Oct. 18-4.

" CAR COUPLERS, Gifford, *Ry. Gaz.* Oct. 2; Hien, Oct. 2-5; Hill, *Eng.* May 20-7; holocaust (injuries by), *Ry. Gaz.* Sep. 18, 25-5; Janney and Miller interchangeable, McConway, Feb. 1-4; Janney, Oct. 2-5; at Inv's Exhib. *Eng.* May 1-5; Lorraine, *Ry. Gaz.* Dec. 23-7; Marks, Oct. 2-5; on Mass. R.'s, *Sci. Am. Sup.* Oct. 18-4.

" CAR COUPLERS, McKeen, *Ry. Gaz.* Oct. 2-5; do. May 28, July 23; Miller hook, Apr 16-6.

RAILROAD CAR COUPLERS, and Janney interchang., McConway, *Ry. Gaz.* Feb. 1-4, pass. and frt. Oct. 2; Perry, Oct. 2; tight and loose, mechan. difference between, May 29; Titus, Oct 2; Thurmond, Oct. 2-5; trials, *Eng. News*, May 7, rep. Dec. 17-7; do. at Buffalo, 42 illus. *Sci. Am. Sup.* Oct. 10-5; do. tables, *Ry. Gaz.* Sep. 18, 25-5; N. Y. R. Coms. rep. Aug. 6-6; Wilson, Oct. 10-4.

" CAR, dead wt., cost of, *Ry. Gaz.* Feb. 16, 16-3; derrick, stm. Aug. 1-4; do. Oct. 23-5; dining, C. B. & Q. Jan. 15-6; do. Mich. Cen. Aug. 19; drawing room interior, Wason, Bost. & Albany, Oct. 21-6; dumping, see R. CAR, FRT., dumping; dynagraph *Sci. Am. Sup.* Sep. 6-4; dynamometric, French, Jan. 27-3; earnings, loss of while repainting, *Ry. Gaz.* Oct. 5, Nov. 9-3; excursion, "Yellowstone," Oct. 3-4; fire extinguisher operated by derailment brake, Pitts. Cin. & St. Louis, Mar. 18-7; flanging, *Eng. News*, Sep. 19-5.

" CAR, FREIGHT, special, *Ry. Gaz.* Aug. 3-3; carrying capac. Oct. 5-3; table, Oct. 2-5; Am. and English, Feb. 8-4; *The Eng.* standard, Hilldrup, *Ry. Gaz.* Mar. 7-4; do. framing, Howe truss, Mar. 6-5; do. M. C. B. June 12; end platforms for, Oct. 23-5; best size of, Apr. 8; and truck, 30-ton, Mich. Cen., Susemihl, Mar. 25-7; of future, Garey, *Mech.* May 19-3; lumber, standard sizes, M. C. B. rep. *Ry. & Eng.* Aug.-7.

" CAR, FRT., box, No. Pac. *Ry. Gaz.* Aug. 31-3; do. framing, Nov. 4-7; do. Russian, May 8-5; do. cost, *Iron Age*, Jan. 6-7; do. bodies, *Sci. Am. Sup.* Dec. 3-7; do. N. Y. West Sh. & B. *The Eng.* Jan. 18-4; brake, ratchet, do. *Ry. Gaz.* July 25-4; do. trials, M. C. B. *Ry. & Eng.* Mar.-7; brakes and couplers, Iowa R. Coms. rep. June-7.

" CAR, FRT., coal, standard, Phil. & Reading, *Ry. Gaz.* July 18; couplers, Sep. 26-4; do. and buffer, McKeen, May 13; do. Browning, Feb. 25-7; door, fastening, Scanlan, May 25-3; do. hanger and seal locks, Dunham, Oct. 22; do. Wagner, Jan. 1-6; draw gear, standard, Norfolk & West. Aug. 8; draw heads, 42, Sep. 19-4; dump, Blaine, July 29-7; do. Goodwin, July 16-6; dumping, Bagnall's, *Sci. Am. Sup.* Feb. 7-5.

" CAR, FRT., gondola, double hopper, Marden, *Ry. Gaz.* Dec. 16-7; locks, seal, Dunham, Oct. 22-6; do. gravity, Feb. 11-7; marking, fast frt., M. C. B. rep. Mar. 28-4; rates, load, May 6-7; rules, interchange, June 29-3.

RAILROAD CAR, FRT., rules, exchanged, *Ry. Gaz.* July 25-4; do. M. C. B. rep. May 21-6; stock, Burton, Sep.9-7; do. double-deck, Apr. 23-6; truck, standard, Rich. & Dan. Apr. 10-5; do. proposed M. C. B. June 12, 26-5; do. 40,000 lbs. July 9; do. Lehigh Valley, July 23; do. center plates, July 30; do. standard, Bost. & Albany, Nov. 5-6.

" CAR HEATING, by stm. *Eng. News*, Apr. 2-7; do. *San. Eng.* Jan. 29; do. various methods, Feb. 19; do. Mar. 5, test do. 19, 26-7; do. systems, W. A. Smith, *The Eng.* Dec. 28-7; lighting and seats, *Ry. Gaz.* Mar. 2-3; couplers, Dec. 2-7; *Ry. & Eng.* Feb.-7; stm. etc., Karr, *Sci. Am. Sup.* Apr. 9, June 4-7; Baker, *Ry. Gaz.* Mar. 11; Bost. Rev. B. & Lynn sys. Nov. 4; do. couplers, Dec. 2; continuous, couplers, Curtis', Dec. 23; couplers, different systems, Dec. 2-7; Curtis' frost proof stm. trap for outlets, *Am. Eng.* June 1-7; Emerson sys. Mar. 30-7; do. coupler, *Ry. Gaz.* Dec. 2-7; Gold sys. Nov, 12-6; do. June 3, 17, Oct. 21, 21; do. coupler Dec. 2-7; do. *Sci. Am. Sup.* Dec. 4-6; Gold and Baker heaters, *Ry. Gaz.* Dec. 2, 16; Hitchcock coupler, Dec. 2-7.

" CAR HEATING, hot air, Pearce, inv. *Am. Eng.* Sep. 21-7; Martin, *Ry. Gaz.* Jan. 21, do. coupler, Dec. 2; in Mass., table, Dec. 23; McGee coupler, Dec. 2; Pennycuick sys. Oct. 28; do. coupler Dec. 2; press. reg., Keiley, Oct. 7; Safety Car Heating and Lighting Co.'s sys. May 13; do. coupler, Dec. 2; Sewell sys. Apr. 29; do. coupler, Dec. 2-7; do. Karr, *Sci. Am. Sup.* Dec. 24-7; Smith & Owen heater, *Ry. Gaz.* Feb. 25-7; standard, Dec. 5-4; Westinghouse's sys. *Am. Eng.* Jan. 26-7; Williams' coupler, *Ry. Gaz.* Dec. 2-7.

" CAR, life and profits of, Spalding, *Ry. Gaz.* Aug. 20-6; *Iron Age*, Sep. 16-6; do. West. & Atlan. *Sci. Am. Sup.* Oct. 9-6.

" CAR LIGHTING, *Ry. Gaz.* Apr. 15, Nov. 18-7; by elec., Goepel, *Elec. Rev.* Sep. 17, 17; Barrett sys. Dec. 31-7; by elec., incand., Boston & Prov. Nov. 15-4; elec. lamp, Munich, Sep. 27-3; do. Kirby, *Ry. Gaz.* Apr. 22; Pintsch sys., France, Nov. 11-7; do. with oil gas, Apr. 6-3; do. lamp, May 22-5.

" CAR, loading mach., Kane, *Am. Eng.* Jan. 21-6; lubs., expts., France and Belgium, *Ry. Gaz.* Mar. 5-6; do. in Europe, Grossman, Oct. 30-5; do. *Am. Eng.* Feb. 8, 15-4; mileage and repair, cost, Spalding, *Ry. Gaz.* Dec. 17, 17-6; oiling regulations, Saxon State Ry. Dec. 4-5.

RAILROAD CAR, Painters, Master Car and Locom. Assoc. pro. *Ry. Gaz.* Sep. 23-7; paints, relative durability of simple and comp. *Sci. Am. Sup.* Nov. 14-5; parlor, Mann boudoir, *Ry. Gaz.* Dec. 14-3; do. smoking, with Frost light, Penn. R. Mar. 26-6; do. palace, Am. *The Eng.* Aug. 29-4; platform and coupler, Blackstone, *Ry. & Eng.* May-7; coupler pats., Miller, June, Sep, Oct.-7.

" CAR, PASSENGER, window blinds, flexible, Wilson, *Ry. Gaz.* Nov. 16-3; bay-window, Penn. R. Aug. 29; officer's, Pitts. Cleve. & Toledo. July 25; painting, light vs. dark, McKeen, Nov. 7-4; seats, June 22-3; do. Forney, June 4-6; do. Mar. 25-7; do. *Ry. & Eng.* Mar.-7; do. Henry tilting cushion, *Ry. Gaz.* Dec. 18-5; ventil. Jan. 12-3; do. Aug. 1-4.

" CAR, postal, Harrison, *Ry. Gaz.* Jan. 29-6; refrigerator, rubber, Ayer, Aug. 15; do. Ely, June 6-4; do. door fastener, Cloud, Mar. 12-6; Wickes, N. Y. L. Erie & West. Feb. 4-7; rolling stock, Am. *Sci. Am. Sup.* Apr. 2-7; rules, interchange, *Ry. Gaz.* July 10-5; Nov. 19-6; service and stations, Jan. 26-3; shifting at Harrisburg, Dec. 10-6; shop, pass., Balt. & O. Aug. 22-4; special, for Gruson ar. plate, *Eng. News*, Apr. 30-7; springs, helical, tests, Cloud, *Ry. Gaz.* May 30-4; do. N. E. R. club discuss. Mar. 19-6; car transfer, Ramsey's, rep. *Fran. Inst.* Sep.-6.

" CARS and locoms., relative wts. of, *Mech.* Oct. 20-3; do. *Nat. Car Builder*; coal hopper, stm. derrick and car for pat. Ry. *Sci. Am. Sup.* May 31-4.

" CAR TRUCK, diamond, *Ry. Gaz.* Apr. 6; standard, Apr. 27-3; center support, Finlay, July 11; center plate, Aug. 22; continuous frame, Nov. 7-4; 6-wheel, for Kan. City, C. B. & Q. Apr. 2-6; frt., Cen. Pac. *Sci. Am. Sup.* Mar. 1-4; pass., Penn. R. *Ry. Gaz.* Dec. 9-7; radial suspen., Robinson, *Mech.* June 16-3; 4-wheel palace, Am. *The Eng.* Sep. 26-4; trucks, iron timber, Apr. 2-6; do. variable gauge, Mackinlay, *Eng.* May 1-5.

" CAR TRUCK AXLES, breakages, German, *Eng. News*, Oct. 31-5; divided, *Sci. Am. Sup.* Nov. 14-5; friction testing ap., lathe, *Ry. Gaz.* May 22; boxes, expired pats. on, May 29; do. standard, Saxon State Ry. Dec. 4-5; do. radial, Bottomley's, *The Eng.* June 19-5; and shoes, *Ry. Gaz.* Oct, 30-5; strengthening, Griggs, Apr. 9-6.

RAILROAD CAR TRUCK AXLES, standard, Eastern R., France, *Ry. Gaz.* Apr. 30-**6**; tests, table, Paxson, Feb. 11; bearings and lub., N. E. R. Club discuss. Nov. 18-7; steel, Coffin, *Iron Age*, Dec. 1-**7**; do. *Mech.* Dec.-**7**; do. *Ry. Gaz*, Dec. 23-**7**; and wheels, *Mech.* May-**6**; effect of cold on, tests, *Ry. & Eng.* Apr.-**7**.

" CAR TRUCK, check chains, *Ry. Gaz.* Mar. 14-**4**; do. Feb. 27; journal friction and train resist. expts., Wellington, June 5, July 24-**5**; journal box, Vogt, *Ry. & Eng.* Jan.-**7**; do anti-friction, Sharpneck, *Am. Eng.* July 27-**7**.

" CAR WHEEL, Allen, *Ry. Gaz.* Jan. 19-**3**; do. *Ry. & Eng.* Feb; Arbel disk, Mar.-**7**; breakage, *Ry. Gaz.* June 1-**3**; breakages on English Rys. *Ry. & Eng.* June–Sep.-**7**; Wellman, *Ry. Gaz.* Mar. 23-**3**; do. J. M. Ford, Feb. 1-**4**; and pulley, Josef Wheel Co. *Iron Age*, May 26-**7**; and rail relations, Forney, *Ry. Gaz.* June 20, 27; axles and draw-bars, M. C. B. standard, Nov. 21-**4**; base, flexible, Grover, Mar. 22-**6**; Whitney chill for castings, *Ry. & Eng.* Feb.-**7**; chilled, casting, Balt. Car W. Co. *Sci. Am. Sup.* Apr, 4-**5**; exports, *Iron Age*, Sep. 20-**3**; do. *Ry. World*; gauges, *Mech.* Feb. 24-**3**; grinding mach., Lindstrom, *Ry. Gaz.* Apr. 22-**7**; and axle, bill forms, Sep. 18, Oct. 23-**5**; manuf. *Mech.* Sep. 8-**3**; rolling mach., Fowler, *Iron Age*, Sep. 15-**7**; service, *Ry. Gaz.* Feb. 2, Mar. 9-**3**; skidding, steel scale from, Head, *Ry. & Eng.* Oct.-**7**; standard, tread and flange, M. C. B. *Ry. Gaz.* Oct. 2-**5**.

" CAR WHEELS, and axles, *Mech.* May.-**6**; bad, *Ry. Gaz.* June 5, 12; cheap, Apr. 24-**5**; chilled, Whitney contracting, May 20; defect gauge, standard, July 29-**7**; English, Apr. 18, 25-**4**; flat, Oct. 22-**6**; independent, Feb. 11, Mar. 11-**7**; micros. struct. of, *Eng.* Nov. 5-**6**.

" CAR WHEELS, paper, *Iron Age*, June 16-**7**; prices, interchange and axles, *Ry. Gaz.* July 17. 31-**5**; running gear tests, Northern Ry., France, Apr. 29-**7**; scrap, Feb. 9, and Car Bu.'s club, Feb. 2-**3**; skidding, steel specimens produced by, Head, *The Eng.* Sep. 9-**7**; So. Mahratta Ry. Apr. 3-**5**; steel, *Iron Age*, Mar. 12-**5**; do. Krupp, *Ry. Gaz.* Dec. 18; do. turning, Dec. 11-**5**; do. vs. cast iron, Jan. 12-**3**; do. vs. chilled, M. C. B. Nov. 13, 27-**5**; do. do. Jan. 1-**6**; do. spring plate, Apr. 24-**5**; do. elastic, Miltmore's, *Sci. Am. Sup.* Oct. 6-**3**.

RAILROAD CAR WHEELS, steel-tired, Snow, *Sci. Am. Sup.* July 27-**3**; do. Feb. 13-**5**; strength of cast iron, Feb, 9, 16-**3**.

" CAR WHEEL, tire and axle fastening, standard, German, *Ry. Gaz.* Feb. 20-**5**; breakages, in '86, German, July 15-**7**; fastening, Cloud, *Ry. & Eng.* May-**7**; and flange, standard, M. C. B. *Ry. Gaz.* June 12; turning on axles, June 19-**5**.

" CAR WHEEL tread, Melber, *Am. Eng.* Apr. 3-**5**; turning mach., Miles, *Ry. Gaz.* Feb. 12-**6**; wheels, wt. of, Apr. 20, 27-**3**.

" CATTLE GUARD, Kan. C. & Omaha, *Eng. News*, July 30-**7**; chemists, Am. Assoc. pro. *Ry. Gaz.* July 15; city pass. traffic, May 6; club, Western, pro. Feb. 4-**7**; coal pockets, N. Y. L. Erie & West. Oct. 5-**3**; color blindness, tests, Sep. 9-**7**; commissions, state, Aug. 24; 10 years of (Mass.), June 15; combinations, Fink, Sep. 21-**3**; companies as manufacturers, *Eng.* Feb. 25-**7**.

" CONSTRUCTION, *Eng. News* files; Gordon's economical, discuss. *Eng. News*, July 31-**6**; engineering, So. Penn. Jan. 15-29-**7**; bracket girder, N. Y. West Sh. & B. *Ry. Gaz.* May 11-**3**; see also R. bracket girder, distrib. of material, Jan. 11; 4 years of, Aug. 1, 8-**4**; rapid, Canadian Pac. *Mech.* Sep. 15-**3**; do. E. T. Abbott, *Sci. Am. Sup.* Apr. 11-**5**; spirals, Georgetown, B. & Leadville, *Ry. Gaz.* Nov. 27-**5**; U. S., in '82, *Mech.* Jan. 27, Mar, 17-**3**; do. '30-'84, table, *Sci. Am. Sup.* Oct. 24-**5**; do. early objections to, *Mech.* Mar. 31-**3**.

" CRANE, 10-ton, Indus. wks. *Ry. Gaz.* July 31-**5**; locom., stm. June 4-**6**; do. Taff Vale Ry. *The Eng.* Jan. 16-**5**; hand, 5-ton, Sep. 30-**7**.

" CROSSINGS, Buffalo, *Eng. News*, Oct. 29-**7**; grade, Mass. R. Coms. rep. *Ry. Gaz.* Mar. 7-**4**; gates, aut., Connell, Aug. 28-**5**; do. Parks (train protecting bar), *The Eng.* June 12-**5**; signals, see R. SIGNALS; stops, state laws, *Ry. Gaz.* Jan. 1-**6**.

" CULVERTS, pipe, *Eng. News*, May 16-**5**; timber box, Chic. Mil. & St. P. May 22-**6**; *Ry. Gaz.* May 14-**6**; proportions, *Eng. News*, Sep. 18-**6**; do. *Ry. Gaz.* Sep. 10-**6**; sewer pipe for, Aug. 31-**3**; Jan. 23-**5**; Dec. 3-**6**; Rich. Fred. & Pot. Mar. 6-**5**; iron pipe, C. B. & Q. Feb. 25-**7**.

CURVES, *Eng. News*, July 2-**7**; metric, Oct. 13-**3**; elevation, *Ry. Gaz.* Dec. 3; widening gauges on, Sweeney, Apr. 30-**6**.

RAILROAD DRAINAGE, and roads, Paine, *Sci. Am. Sup.* Dec. 20; do. *Ry. Gaz*; draw-bridge, aut., elec. protection for, Apr. 11-4; do. interlocking ap., Old Col. Dec. 25-5. See also BRIDGES.

" DITCHING MACH., Am. *Ry. Gaz.* June 13-4; ditcher, McGrew, Aug. 20-6; and dock wks., Brit. Assoc., Brunlees, *Eng. News*, Oct. 27, Nov. 3-3; dynamometer and train resist. on govt. Rys., Saxony, *Ry. Gaz.* May 1-5.

" EARNINGS, *Ry. Gaz.* Aug. 17, Sep. 7-3; do. '85, Feb. 12-6; earthwork, Specht, *Eng. News*, Aug. 22-5; do. area cross-section by graphic meth., Dubret, *Van Nost.* Jan.-3; economical, Am. and English, *Eng.* Mar. 26-6; economics, *Ry. Gaz.* Jan. 5, 19-3; do. Gordon, *Sci. Am. Sup.* May 1-6.

" ELEC. calls and ap., Vienna exhib. *Eng.* Jan. 18, 25-4; do. light plant, portable, Suakim-Berber Ry. *Sci. Am. Sup.* May 16-5; do. *Elec. World*, May 2-5; do. *Eng.* Apr. 3-5; elevators, hydr. car lift, St. Lazare frt. station, Paris, *Ry. Gaz.* Nov. 18, 18-7; do. Mersey Ry. hydr. lifts, *Eng.* May 14-6; embankment slide (artif. earthquake), Penn. R. *Ry. Gaz.* June 24-7.

" EMPLOYEES, number, U. S. *Mech.* Mar. 3-3; sickness and mortality, *Ry. Gaz.* Mar. 30-3; relief assoc., Balt. & O. rep. Mar. 21-4; do. Mar. 27-5; do. May 21-6; English stat. Jan. 14; education on Balt. & O. Apr. 22; trainmens' premiums, Sep. 2, 23, Oct. 7; exam., C. B. & No. Dec. 9-7.

" ENGINEERING, (laying out), Wellington, *Ry. Gaz.* Dec. 3-6; do. education, Jameson, *Soc. Arts*, Oct. 28-6; engine shed, Lond. & No. West. *Ry. Gaz.* May 4-3; excavator, stm., and ballast trains, Dec. 25-5; do. Dunbar's, Nov. 13-5; do. Osgood Dredge Co. Nov. 26-6; do. mach., Chic. exhib. *The Eng.* Sep. 14-3; exhib., Chicago, *Mech.* Oct. 6-3; do. *Ry. Gaz.* July 6-20; expenses, operating, Erie & N. Y. Cen. Jan. 12-3; do. op., motive power, May 25-3; do. anal., Rich. & Dan. Feb. 1-4; English and Am. *Eng.* Oct. 30-5.

" FENCE, *Eng. News*, June 13-5; ferry boat Solano, Cen. Pac., San Fran. Aug. 23-4; do. do. *Sci. Am. Sup.* Aug. 25-3; do. San Juan, Puerto Rico, *Eng.* May 16-4; do. Cen. Pac. *Iron Age*, Aug. 2-3; do. *Eng.* July 6-3; and car transfer, Portland, Or. Ry. & Nav. *Ry. Gaz.* Aug. 7-5; stm., Danish State Rys. *Ry. & Eng.* Nov.-7; first in Am. *Iron Age*, Feb. 18-6; do. *Fran. Inst*; do. *Ry. Gaz.* June 11-6.

RAILROAD FREIGHT, claim dept. *Ry. Gaz.* Nov. 4-7; cotton movement, May 11, Dec. 14-3; do. Oct. 9-5; credits and miscel. charges, Kirkman, Sep. 12; delivery, do. Sep. 26-4.

" FRT. GRAIN, movement, winter, *Ry. Gaz.* Apr. 13, May 11-3; Feb. 22; distrib. Feb. 29-4; June 26-5; Feb. 11-7; corn crops, Chic. to eastward, July 13, Sep. 14, 14-3; Chic. lake commerce, Jan. 11, 11, 18-4; shipments, Dec. 14, 21-3; and canal receipts at N. Y. Jan. 25-4; and live stock, Chic. receipts, Jan. 16; do. receipts of eastern ports, Jan. 30; frt. rates, for 20 years, Jan. 9-5; receipts, No. Western, Mar. 5-6; movement of flour, wheat and commerce, Feb. 11-7.

" FRT., live stock movement eastward, *Ry. Gaz.* Sep. 30-7; loading, cost of, *Iron Age*, May 14-5; loading gauge, English, *Ry. Gaz.* Oct. 10; at N. Y. Oct. 31-4; do. Feb.6 ; pork packing, Dec. 25-5; do. summer, Nov. 23-3; profit dec. on through from West, Feb. 15-4; rates and class. May 13-7.

" FRT., traffic, the year, *Ry. Gaz.* Dec. 26-4; do. and crops, Nov. 23-3; do. trunk line stat. June 12, Dec. 25-5; do. Feb. 4; do. local and through, Mar. 25-7; transport. effic. of, June 1-15, and pass. May 11, 25-3; do. table, Apr. 29-7; do. cost, England and U. S. May 1-5; do. expense, foreign, Dowden, *Van Nost.* June-6; way-bills, Kirkman, *Ry. Gaz.* Sep. 5-4.

" FRTS., class. *Iron Age*, Mar. 17, 24, Apr. 14-28, May 5, 12-7.

" GAUGE changing, East Tenn. *Ry. Gaz.* June 4-6; Mobile & Ohio, May 14, 21-6; on Southern R's in '85, Hudson, Nov. 11, in '86, Oct. 14-7; do. *Sci. Am. Sup.* Dec. 3, 10-7; gates, see R. CROSSINGS, GATES.

" GAUGES, in Am. *Eng. News*, Aug. 9-4; do. *Eng*; contest, *Ry. Gaz.* Oct. 12-3; Southern, origin, Aug. 27-6.

" GRADE, adjustment to curves, Whittekin, *Eng. News*, Mar. 8-4; crossing collisions, July 30-7; curves gradient reduction, Vincent, *Van Nost.* Sep. 4; profiles, condensed, *Ry. Gaz.* Feb. 6-5; descent, So. Park & Pac., map, Dec. 24-6; max. for econ. May 20-7.

" GRADES, of world, profile chart, *Eng. News*, Sep. 3-7; effect of vel. in reducing, *Ry. Gaz.* Nov. 26-6; actual and virtual, Oct. 7-7; guard rail, standard, Penn. R. June 12, Aug. 21-5; hist., early, H. Allen, Apr. 4, 11-4; do. 1st train, Balt. & O. *Eng. News*, Nov. 8-4.

RAILROAD INCORPORATIONS, U. S., '82, *Eng. News*, Feb. 17, 24-3; imps. do. Mar. 3; instructions to section foremen and bridgemen, *Ry. Gaz.* Sep. 21; do. Westinghouse brake, Sep. 14-3.

" INTERSTATE COMMERCE, bill, *Eng. News*, Jan. 29-7; interstate transport., U. S., rep. *Ry. Gaz.* Jan. 22; Cullom bill, Feb. 26, May 21-6.

" LAND records, *Ry. Gaz.* Jan. 16-5; legislation in England, Tratman, *Eng. News*, Aug. 1-5; live stock, development of grazing on the great plains, *Ry. Gaz.* June 22-3.

" LOCATION, Wellington, *Eng. News.* May 7-21-7; do. over Blue Ridge, West. No. Car. R. *Sci. Am. Sup.* Mar. 26-7; Jameson, *Ry. & Eng.* Nov, Dec.-7; in relation to econ. of service, *Am. Eng.* Apr. 1-6.

" LOCOMOTIVES. See also RAILWAYS, STREET, LOCOMS.

" LOCOMS., in U. S., number, n. *Eng. News*, Feb. 7, Oct. 3-5; adhesion to track (hammer blow in), *Fran. Inst.* Jan.-7; Am., evolution of, Oct.-6; do. early, *Iron Age*, Sep. 17-5; do. do. "Best Friend," "West Point," *Mech.* Sep.-5; do. *Sci. Am. Sup.* Feb. 10-3; do. *Nat. Car Builder*; do. *The Eng.* sup. Feb. 2-3; do. cost of, n. *Eng.* Dec. 23-7; do. heavy, n. *Mech.* Aug.-6; mogul, Newfoundland Ry. *The Eng.* Jan. 19-3; do. Apr. 17; do. for New Zealand, Nov. 27-5. anthra. vs. bitum. coal burning, *Ry. Gaz.* Apr. 1-7; Austria, express, Northern Ry. *The Eng.* sup. Oct. 2-5; aux. stm. generator, Sep. 2-7; axles, England, *Eng. News*, Aug. 30-4; do. *Ry. Gaz.* June 11-6.

" LOCOMS., BALDWIN, wks. *Eng. News*, Apr. 9-7; for Chili, *Ry & Eng.* July-7; consol. frt., Chic. exhib. *Ry. Gaz.* June 22-3; do. *The Eng.* Feb. 1, 1-4; pass. do. *Ry. Gaz.* June 29; narrow g. consol. July 13-3; mogul, New So. Wales, Mar. 27; "decapod," Mar. 20, 27, May 1-5; *Sci. Am. Sup.* May 30-5; built by wks., table, *Ry. Gaz.* Mar. 25-7.

" LOCOMS., BELGIAN State Ry. *Ry. Gaz.* Mar. 26-6; *Eng.* Feb. 12, Nov. 5-6; *The Eng.* Apr. 8-22-7; pass. Feb. 5-26-6; goods and shunting, Apr. 23-6; steep gradient pass. Sep. 11-5.

" LOCOM., bell, stm. *Sci. Am. Sup.* Oct. 11-4; bell ringer, Latow ski, Germany, *Ry. & Eng.* Apr.-7; Belpaire fire-box, consol., Louisville & Nash., Wells, *Ry. Gaz.* Oct. 24; do. Norfolk & West. Dec. 12-4; blast pipes, *The Eng.* July 1-7.

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OAD LOCOM. BOILER, Lanson, *Ry. Gaz.* Oct. 16-5; ashpan, t., Hart, Sep. 26-4; blast pipe, Old Col., Lauder, June 11-6; nstruct. (English b's), Mas. Mech. rep. Oct. 12-26, Nov. 3; crown bars, Grigg's, July 25-4; explosions, Brit. Rys., p. *Ry. & Eng.* Nov, Dec.-7; feed water heater, Rushforth, y. *Gaz.* Apr. 15; do. Fairbanks, June 3-7; fittings, Manchester exhib. *The Eng.* July 15-7.

OCOM. BOILER, fire-box, Wootten, Phil. & Reading, *Ry. Gaz.* eb.29-4; steel fire-boxes, Forney, *The Eng.* Apr. 13-3; furace plate, limit of thickness, *Ry. Gaz.* Nov. 11-7; fire-brick rches and spark arresters, expts. Nov. 6-5; do. Danish tate Rys. Nov. 5-6; grate surface, *Iron Age*, Oct. 7-6; do. *The Eng*; do. as a factor in rapid transit, Galloupe, *Mech.* Oct.-5; furnaces, petroleum as fuel in, Urquhart, *Sci. Am. Sup.* Sep. 20-4.

LOCOM. BOILER, gauge glass, Schwartzkopf, *Ry. Gaz.* Mar. 11-7; heating surface effic., expts. *Am. Eng.* Dec. 24-5; lagging, *Mech.* Nov.-5; plates, steel for, Webb, *Mech.* Aug.-5; safety attachments, Burgermeister, *Ry. Gaz.* Oct. 3-4; smokestack, chimney for anthracite coal, N. J. Cen. June 1-3; stays, diagonal, Dec. 3-6; tests, Sep. 4, 11; do. hydr. Sep. 18-5; do. Mas. Mech. rep. *The Eng.* Nov. 13-5; water gauge, Summerson, *Ry. Gdz.* May 8-5; do. *The Eng.*

" LOCOM. BOILERS, *Mech.* Mar. 17-3; discuss. Apr.-5; construct. and tests, *Ry. Gaz.* Sep. 4, 11-5; designing, Mar. 2-3; stm. making, C. A. Smith, *Am. Eng.* Jan. 4-4; Bombay Ry. *The Eng.* June 22-3; Mas. Mech. rep. Aug. 28-5; Mar. 12-6.

" LOCOM., bogie, double engs. *The Eng.* Sep. 19-4; and equalizing beam, origin of, Dec. 31-6; brakes, driving wheel, Mas. Mech. rep. *Ry. Gaz.* July 2; do. consol., C. B. & Q. Sep. 3; do. Am. Br. Co. Nov. 12-6; do. and tender, Beals, Sep. 30-7.

" LOCOMS., Brazil, Grt. So. Ry., tank, Black, *Eng.* Sep. 9-7; Brooklyn bridge, tank, Porter, *Ry. Gaz.* Dec. 11-5; Brooks, Chic. exhib., frt. mogul, June 8, do. shifting, June 15; do. narrow gauge, June 1, 15; do. pass. Aug. 17-3; do. *The Eng.* Nov. 16-3; do. 10-wheel, *Ry. Gaz.* Sep. 28-3; do. locoms. built by wks. Apr. 15-7; Buenos Ayres & Pac. Ry. *Mech.* June 21-4; do. *The Eng.* May 30-4; building, in U. S., n. *The Eng.* Sep. 21-3; do. cost of, *Iron Age*, Nov. 3-7; business, Apr. 22-6.

RAILROAD LOCOMS., Caledonian Ry., Scot. *Eng.* July 30; do. express, Dec. 10-6; do. pass. *Ry. Gaz.* Jan. 28-7; do. express, Neilson, *The Eng.* Aug. 13-6; Can. Pac. consol. *Ry. Gaz.* May 6; do. F. R. Brown, June 17-7; do. pass. *Eng.* Oct. 1-6; do. Oct. 21, Nov. 18-7; and car combined, Lehigh Val. *Sci. Am. Sup.* Dec. 6-4; Caracas Ry., Venezuela, *Eng.* Oct. 16-5; do. tank locom. Sep. 25-5; catechism, Forney, *Ry. & Eng.* Nov, Dec; center of grav. Jan.-7; do. *Mech. World*; Cen. Pac., 14-wheel, *Ry. Gaz.* Jan. 18-4; do. 10-wheel frt. *Sci. Am. Sup.* Aug. 11-3; do. "El Gobernador," large, Feb. 23-4; do. frt. *The Eng.* Sep. 26-4; C. B. & Q. pass. *Ry. Gaz.* Nov. 14-4; do. June 11-6; Chic. & No. West., Tilton design, Dec. 23-7; Chicago exhib. July 6-3; see also under Baldwin, Brooks; for Chili, Baldwin, *Ry. & Eng.* July-7; China Rys., first, *Iron Age*, Dec. 11-4; do. 10-wheel tank, Kinder, *The Eng.* Nov. 18, Dec. 16-7.

" LOCOM. COAL, consump. as affected by temp., Klein, *Eng. News*, Dec. 10, 17-7; do. per mile on English and Am. *Ry. Gaz.* Sep. 11-5; do. and length of trains, May 7-6; coal consump. *The Eng.* Jan. 23-5; do. Hodgson, *Ry. Gaz.* May 2-4; do. *The Eng;* do. and balanced valves, *Ry. Gaz.* Apr. 23-6; do. *Am. Eng;* coal delivery, Mas. Mech. rep. *Eng. News*, Sep. 24-7; do. Pitts. Cin. & St. L. *Ry. Gaz.* Apr. 1; Mas. Mech. rep. July 1; station, Hackensack, Penn. R. Sep. 2-7; stage, So. West. Ry., Russia, *Eng.* Jan. 26-3; premiums, Penn. R. *Ry. Gaz.* Apr. 17-5; tests, No. Pac. Apr. 2-6; storage plant, *The Eng.* Aug. 24-3.

" LOCOM., Col. Midland, 10-wheel pass. *Ry. Gaz.* Nov. 25-7.

" LOCOMS., COMPOUND, Borries, *Iron Age*, Mar. 10-7; do. *Mech.* Sep.-5; econ. of, *Ry. Gaz.* Apr. 16-6; *Eng.* Jan. 1, 8, 22, Feb. 5-6; *The Eng.* Oct. 9-30, Nov. 20-5; Brazil, *Iron Age*, Oct. 29-5; do. and stm. jacketed, Oct. 7-6; do. Paulista, Sharp, *Mech.* Nov.-5; English, *Am. Eng.* July 10-5;

" LOCOMS., COMPOUNDED, and stm. jacketed, in Russia, expts., Borodine, *Am. Eng.* Sep. 8-29, Oct. 6-6; *The Eng.* Aug. 20-6; German, Am. exhib. *Ry. Gaz.* Jan. 11-4; do. do. Van Borries sys. Oct. 15-6; do. *Eng.* July 16-6; do. Hanover Ry. *The Eng.* Mar. 18-7; on German Rys. *Locom.* Nov.-4; hist. *Ry. Gaz.* Aug. 28-5; trial, Aug. 12-7; Webb's, *Sci. Am. Sup.* Nov. 28-5; do. Lond. & No. West. *The Eng.* Aug. 3-3; do. Compauliva Paulista, sup. Oct. 30-5.

RAILROAD LOCOMS., COMPOUND, *Eng.* Jan. 22, Aug. 10-**3**; Sep. 11, 25, Oct. 2, 9, 23, Nov. 6, 20, Dec. 4-18-**5**; and stm. jacketed, Sep. 3-24-**6**; Lond. & No. West. Aug. 10; Amsterdam exhib. Oct. 12-**3**; express, Hanover, Apr. 30; India, Sep. 3-**6**; No. East. Ry., Worsdell, June 17; do. goods, Sep. 23-**7**; *The Eng.* Aug. 31-**3**; Feb. 15-**4**; Worsdell's, Grt. East. May 15, 15-**5**; Burgess design, Jan. 29; in India, Sandiford, Aug. 27; Nisbet's, No. Brit. Oct. 22-**6**; Feb. 18, 25, June 3-**7**.

" LOCOM. CONNECTING RODS, broken, *Eng. News*, Nov. 5-**7**; strains on at high speeds, *Mech.* May 10, 17-**4**; *Mech. World; Ry. Gaz.* Feb. 15-**4**; solid eyes, n. *Locom.* Apr.-**7**; *Ry. & Eng*; rods, Ches. & O. *Ry. Gaz.* Apr. 10-**5**; J. B. Johnson, Sep. 16; strains in, do. Nov. 4, 4-**7**.

" LOCOM., construction, Stroudley, *Eng.* Mar. 6-**5**; do. and working, Lond. Brighton & So. Coast, do. *The Eng.* Mar. 20-**5**; consol., Can. Pac. *Ry. Gaz.* May 6-**7**; do. *Eng.* Oct. 21, Nov. 18-**7**; contractor's tank, Pecket, *The Eng.* Mar. 11-**7**; cost of Am., n. *Eng.* Dec. 23-**7**; counterbalancing, Vielhaber, *Iron Age*, Oct. 6-**7**; do. *Mech.* Oct.-**7**; do. *Ry. Gaz.* Oct. 14, 14, 28-**7**; coupler, Wilkins, *Iron Age*, Apr. 22-**6**; do. *Ry. Gaz.* Jan. 8; Cowles' pat. for pole Rys. Feb. 19, Apr. 16-**6**; crank axles, *Mech.* Oct.-**4**; do. Lond. & Brighton Ry. *Sci. Am. Sup.* Apr. 16-**7**; do. Stroudley, do. *The Eng.* Mar. 4-**7**; Crompton's designs, May 7-**6**; do. *Eng.* Feb. 19-**6**.

" LOCOM. CYLINDER, capac. *Ry. & Eng.* Sep.-**7**; piston speed, table, *Power & Trans.* July-**7**; cocks and spring relief valve, *Ry. Gaz.* Oct. 21-**7**; packing, metallic, piston rod, Jerome's Am. *The Eng.* Oct. 7, 7-**7**; port slotting mach., Miles, *Ry. Gaz.* Feb. 22-**4**; proportions, Atkinson, *Iron Age*, May 12; formula, July 14-**7**; Mas. Mech. rep. *Ry. Gaz.* July 1-**7**; *Ry. & Eng.* Sep, Oct.-**7**; Am., rep. *The Eng.* Dec. 30-**7**; water relief and safety valve, Vielhaber, *Iron Age*, Oct. 6-**7**.

" LOCOMS., Danish State Ry. pass. *The Eng.* Jan. 26-**3**; design, Aug. 13-**6**; Dick, tank, Inv's exhib. *Eng.* June 19-**5**; drivers' premiums, Mas. Mech. rep. *Mech.* Aug. 4-**3**; driving-box oiler, Campbell, *Ry. Gaz.* Jan. 26-**3**.

" LOCOM., DRIVING-WHEELS, and dead blocks, M. C. B. standard, *Ry. Gaz.* Nov. 5-**6**; effect of change in diam. on econ., Holmes, *Am. Eng.* June 12-**5**; hammer blow of, rep. *Fran. Inst.* Oct.-**6**; tire expan., gas ap. for, *The Eng.* May 11-**3**.

RAILROAD LOCOM. DRIVING-WHEEL tires, steel, tests, *Iron Age*, Nov. 5-5; wear of, Sep. 9-6; do. heating and setting mach., Gentry's, *The Eng.* July 22-7.

" LOCOMS., Dundee Ry. *The Eng.* Mar. 2-3; Dutch Rys., tank, *Eng.* Nov. 7-4; early, West Point foundry, Chic. exhib. *Ry. Gaz.* May 25-3; do. Nat. museum, Mar. 5-6; see also R. LOCOMS., AM; eccentrics, throw of, *Iron Age*, Jan. 13-7; do. *Ry. Gaz*; econ. *Eng.* Oct. 16; grate surface, Galloupe, Oct. 22-5; do. *Mech.* Oct.-5; do. tests, Oct. 29-5; elec., Field's, *Ry. Gaz.* Nov. 11-7; see also RAILWAYS, ELEVATED, ELECTRIC.

" LOCOM. ENGINEERS, Brotherhood of, hist. and aims, *Iron Age*, July 8-6; Locom. Engineer's New Years (fiction), Weber, *Ry. Gaz.* Dec. 26-4; English, durabilty, Mar. 12-6; do. *Sci. Am. Sup.* July 24, Aug. 21-6; do. *Eng.* Feb. 12, Mar. 5, Apr. 2, 9, 30, May 14, July 2, Dec. 3-6; Feb. 11, May 6–20, June 17, July 22, Oct. 7, 14, Nov. 11-7; do. *The Eng.* June 8-3; Feb. 5-6; evolution of Am. *Fran. Inst.* Oct.-6; exhaust damper, variable, Luttgen, *Ry. Gaz.* Oct. 1-6; expenses, England, *Eng.* Nov. 26-6; do. wear of mach, *The Eng.* Mar. 9-3; exports, *Eng. News*, Nov. 21-5; do. and car, *Ry. Gaz.* Oct. 1-6; do. U. S., 12 years, Mar. 25-7; express eng., on an, *Sci. Am. Sup.* June 6-5; do. *The Eng.* Jan. 16-5; Estrade's high speed, France, *Iron Age*, May 27, June 24-6; do. *Sci. Am. Sup.* Apr. 10; Sep. 11-6.

" LOCOMS., Fairlie, Saxony, *Eng.* Mar. 26-6; fast pass., Austin, Nov. 5; do. indicator on, Nov. 5-5; do. *Ry. Gaz;* Festiniog, narrow g. *Eng.* Sep. 26-4; fireless, Honigmann's caustic soda, *Mech.* Nov. 3-3; do. May 10-4; do. *Sci. Am. Sup.* Apr. 4-5; do. *Locom.* Feb.-4; do. *Eng.* Aug. 17, 24-3; do. Feb. 27-5; do. *The Eng.* Jan. 23-5; first, Peter Cooper, Balt. & O. *Ry. Gaz.* Apr. 13-3; do. in Am. Nov. 19; do. with truck, Nov. 26-6; Forney, Thyland's Ry., Denmark, Dec. 26-4; four cyl., for increased tractive power, *Iron Age*, Apr. 1-6; do. *Nat. Car & Locom. Bu*; frame forging, stm. drop for, Devine, *Mech.* June 9-3; France, tank, Cail, Apr.-6; do. effic. of, n. *Am. Eng.* Mar. 21-4; do. tank pass., West. Ry. *Eng.* Jan. 22-6; frt. mogul, Balt. & O. *Ry. Gaz.* Nov. 5-6.

" LOCOM. FUEL, accounts, *Ry. Gaz.* Nov. 30-3; do. consump., Marie, *Van Nost.* Dec.-4; do. Paris & Lyons Ry. *The Eng.* May 9, 9, 16-4.

RAILROAD LOCOM. FUEL, *Am. Eng.* July 25, Aug. 8-**4**; econ., Stevens' valve gear, *Ry. Gaz.* Feb. 1; do. England, Feb. 29; do. Sinclair, July 4-**4**; do. Sep. 30-**7**; waste, *Am. Eng.* June 24-**6**; do. F. C. Smith, *Sci. Am. Sup.* Oct. 31-**5**; energy of in, Cunningham, *Van Nost.* Sep.-**6**; expts., French, Marie, *Ry. Gaz.* Mar. 14-**4**; do. *Eng.* May 9-**4**; petroleum as, *Iron Age*, Nov. 20-**4**; *Mech.* Mar.-**5**; *Am. Eng.* Apr. 20-**7**; n. *Ry. Gaz.* Sep. 12-**4**; n. July 5-**7**; refuse as fuel, Urquhart, *The Eng.* Aug. 15-**4**; fuel records, *Iron Age*, Sep. 9-**6**; consump., Cal. So. *Ry. Gaz.* Apr. 6-**3**.

" LOCOMS., German, 4-wheel tank, *Ry. Gaz.* Sep. 14-**3**; Glasgow & So. West. Ry. Scot. Aug. 14-**5**; do. pass. *Sci. Am. Sup.* Nov. 10-**3**; do. *Eng.* Sep. 21-**3**; Great Eastern Ry. England, frt. *Ry. Gaz.* May 23, 30-**4**; do. pass., Apr. 17-**5**; do. *The Eng*; do. express, *Eng.* Nov. 16, 23-**3**; do. frt. Apr. 4-**4**; do. express, Worsdell design, *The Eng.* Apr. 20, May 4-**3**; do. Worsdell, tank, sup. Mar. 13-**5**; Grt. Northern Ry., England, Sterling des. *Ry. Gaz.* Jan. 29-**6**; do. Newcastle exhib. *Eng.* May 20-**7**; Grt. So. & West., Ireland, *Sci. Am. Sup.* Sep. 5-**5**; do. pass. *The Eng.* June 26, July 17-**5**; Grt. West. Ry. express, *Sci. Am. Sup.* Oct. 30-**6**; do. *The Eng.* Sep. 24-**6**.

" LOCOMS., hammer blow of, *Mech.* Nov.-**7**; do. rep. *Fran. Inst.* Oct.-**6**; Jan.-**7**; do. *Am. Eng.* Feb. 16-**7**; head-lights, elec. *Mech.* Oct. 6-**3**; do. arc, *Elec. World*, Dec. 18-**6**; high and low, *Iron Age*, Oct. 14-**6**; do. Greenhill, *The Eng.* Dec. 2, 9-**7**; high speed, Mar. 14, 21, May 16-**4**.

" LOCOM. HISTORY, "Rocket," *Iron Age*, Jan. 22-**3**; *Mech.* Feb.-**5**; *Ry. Gaz.* Oct. 17-**4**; *The Eng.* Sep. 12, Oct. 10, Dec. 19-**4**; n. Mar. 6-**5**; do. at Liverpool exhib. Feb. 25-**7**; early, Rogers wks. *Ry. & Eng.* Jan.-**7**; early, Liverpool & Manchester Ry. 1834, *The Eng.* Feb. 23, 23-**3**; Dundee Ry. Mar. 2; Crewe, May 25-**3**; Northumbrian, Nov. 7-**4**; list, table, Feb. 13-**5**; in England, T. West, *Am. Eng.* Apr. 29, May 6, 13, Aug. 4-18-**6**; do. *Sci. Am. Sup.* May 15-**6**; wheels of "Novelty," 1829, Jones, *Ry. Gaz.* Dec. 7-**3**; links in, *Sci. Am. Sup.* Oct. 25-**4**; *The Eng.* Dec. 28-**3**; Sep. 12, Dec. 19-**4**; Feb. 6-**5**; outline hist. of Am. *Eng.* Aug. 4, &c.-**6**.

" LOCOMS., Honigmann's fireless, caustic soda, *Mech.* Nov. 3-**3**; do. May 10-**4**; do. *Sci. Am. Sup.* Apr. 4-**5**; do. *Locom.* Feb.-**4**; do. *Eng.* Aug. 17, 24-**3**; do. Feb. 27-**5**.

RAILROAD LOCOMS., Honigmann's fireless, *The Eng.* Jan. 23-**5**; Hungarian State Rys., express pass. sup. May 7, 7-**6**; improvement, Dean, *Mech.* Aug. 18-**3**; do. in France, *Ry. & Eng.* Jan.-**7**; do. *Ry. Gaz.* Jan. 5-**3**; do. type, Chitchell, Lehigh Val. July 18-**4**; to Chicago in 18 hours, Grimshaw, *The Eng.* June 20, July 4-**4**; imps. in, Mas. Mech. pro. *Iron Age*, July 12-**3**.

" LOCOM., Indian State Rys., goods, *The Eng.* Dec. 4-**5**; indicating, *Ry. Gaz.* July 6-**3**; do. Grimshaw, *Mech.* Jan. 27-**3**; do. *Eng.* Nov. 5-**5**; indic. diags., Cin. New Or. & Texas, *Ry. Gaz.* Jan. 2-**5**; do. Norfolk & West. Oct. 9-**5**; do. Sep. 10-**6**; injector Korting, Dec. 19-**4**; do. Webb, *Eng.* May 1-**5**; inside cyl. *The Eng.* Nov. 16-**3**; Italy, *Ry. Gaz.* Mar. 5-**6**; do. pass., Turin exhib. *Eng.* July 11-**4**; Japan govt., tank, Kitson, Dec. 31-**6**.

" LOCOMS., Lancas. & Yorkshire Ry., express, *Sci. Am. Sup.* July 24-**6**; do. do. *The Eng.* June 11, 11-**6**; do. pass. Aug. 26, 26-**7**; light, Antwerp trials, *The Eng.* Apr. 23, 30-**6**; for liquid fuel burning, *Sci. Am. Sup.* Sep. 22-**3**; link motion, Stephenson's, *The Eng.* May 25-**3**; links slotting mach. *Ry. Gaz.* July 31-**5**; Liverpool & Man. Ry. 1834, early hist. *The Eng.* Feb. 23, 23-**3**; logging, Porter, *Ry. Gaz.* Aug. 22-**4**; Lond. & Brighton Ry., express, *The Eng.* Oct. 12; do. & So. Coast, express, Gladstone, Oct. 19, 19, 26, 26-**3**; Lond. & No. West. wks., Crewe, Oct. 3-**4**; do. Webb, May 8-**5**; Lond. & So. West., pass., Adams, *Ry. Gaz.* Aug. 26-**7**; do. express, *Eng.* Sep. 2, Dec. 30-**7**; do. pass., Adams' design, *The Eng.* & sup. Nov. 4-25, Dec. 2-**7**; Man. Ry., express, Sacre, eng. Jan. 2-**5**; Manches. Sheffield & Lin., out. cyl. express, *Mech.* July-**5**; do. *Sci. Am. Sup.* Feb. 7-**5**; Mason, bogie, Prov. Warren & Bristol, *Ry. Gaz.* Apr. 23; do. heavy, pass. June 4-**6**; do. pass., Am. *The Eng.* Jan. 9, 9-**5**.

" LOCOMS., Mersey Ry. and tun., England, *Ry. Gaz.* Apr. 9-**6**; do. tank, *The Eng.* Feb. 19-**6**; Mex. Cen., 4-cyl., Johnstone, *Eng.* Jan. 28-**7**; Mich. Cen., frt. mogul, *Ry. Gaz.* June 10-**7**; Midland, express, *Eng.* Dec, 9-**7**; do. *The Eng.* sup. Feb. 6, 27, do. Mar. 6; pass. (working drawing), sup. May 8-**5**; mountain, Harz, Abt rack-rail, *Eng. News*, May 22-**6**; see also RAILWAYS, MOUNTAIN; muffler, Richards', *Am. Eng.* June 29-**7**; Murphy design, *Ry. Gaz.* Aug. 31-**3**.

RAILROAD LOCOMS., NARROW GAUGE, rack and pinion, *Sci. Am. Sup.* Nov.-3; do. Baldwin, pass. *Ry. Gaz.* Sep. 7-3; do. brewery, Guiness, Dublin, shunting, Jan. 5, 12-3; do. *Eng*; do Brooks, *Ry. Gaz.* June 1-15, Aug. 3-3; do. Conglomerate Mining Co. July 13-3; Festiniog, *Eng.* Sep. 26-4; do. Woolwich Arsenal, 18-in. g. Apr. 24-5; do. *Sci. Am. Sup.* May 30-5; do. metre g., Liverpool exhib. *The Eng.* June 11-6.

" LOCOMS., Newcastle exhib. *The Eng.* July 1-7; do. Newfoundland Ry., Am. mogul, Jan. 19-3; New Orleans exhib. *Ry. Gaz.* Mar. 20-5; N. Y. Cen., pass. *Eng.* May 28-6; charts, *Ry. Gaz.* Feb. 8-4; N. Y. W. Sh. & B., tenders, *The Eng.* Dec. 7-3; Norris (early), *Ry. Gaz.* Feb. 4-7; 1st to ascend heavy grade, Feb. 4, 4-7; No. Brit. Ry., express, Holmes, eng. *The Eng.* Oct. 8-6; Old Col., "Pilgrim" (large), *Ry. Gaz.* Mar. 23; do. Taylor, May 18-3; do. Lauder, Feb. 25-7; Paulista Ry., Brazil, *Eng.* July 10, Sep. 11-5; Penn. R., consol., *Ry. Gaz.* Sep. 17-6; and Reading, pass. *The Eng.* Nov. 20-5.

" LOCOMS. PERFORMANCE, Louis. & Nash. *Eng. News*, June 13-5; reports, Feb. 6-6; returns, *Ry. Gaz.* Jan. 19, Feb. 16, Mar. 2-3; consol. frt., Norfolk & West. May 15-5; on N. Y. Elevated, F. J. Sprague, Mar. 12-6; do. *Electric*; Kan. C. St. Joe & Coun. B. May 13; So. Pac. May 20-7; Stroudley's, Lond. Brighton & So. Coast, *Sci. Am. Sup.* Dec. 1-3; do. *The Eng.*

" LOCOM. piston rod lubricator, Hoffmaster, *Ry. Gaz.* Mar. 28-4; do. packing, Sleeper, Mar. 4; and valve stem packing, standard, C. B. & Q. Aug. 5-7; power, hauling, table, Wellington, *Eng. News*, Mar. 12-7; do. starting do. *Ry. Gaz.* Sep. 3, 10; do. cost in different countries, Jeans, Dec. 10-6; do. N. Y. Elevated Ry., Sinclair, *Sci. Am. Sup.* Oct. 3-5; do. cost of, England, *The Eng.* Dec. 31-6; practice, English and Am., Whitley, *Sci. Am. Sup.* Oct. 11-4; do. *The Eng.* July 4-4.

" LOCOM. repair shops, Taff Vale Ry., Cardiff, Riches, *The Eng.* Sep. 5-4; reverse lever latch, May's, *Mech.* Oct.-6; do. do. *Am. Eng.* Mar. 9-7; do. *Ry. Gaz.* Oct. 8-6; do. *Eng.* Oct. 7-7; reversing gear, screw, Grand Trunk, *Ry. Gaz.* Jan. 7; R. I. Locom. wks., pass. Feb. 11-7; Roanoke Mach. wks., consol. frt., Norfolk & West. May 15-5; Rogers wks., eng. details, *Ry. & Eng.* July-7; do. pass. and frt. *Eng.* Jan. 21-7; rotary, Goodwin, *Ry. Gaz.* Aug. 21-5.

RAILROAD LOCOM. running, Buel, *Ry. & Eng.* Feb.-7; running gear, Aug.-7.

" LOCOM., scales, Howe, *Iron Age*, June 19-4; do. do. portable, *Mech.* May 24-4; Schenectady wks., consol. frt. *The Eng.* Jan. 30-5; screw reversing gear, Grand Trunk, *Ry. Gaz.* Jan. 7-7; Shaw's, Fran. Inst. rep. on, *Am. Eng.* Apr. 4-4; shed, Cardiff, Taff Vale Ry. *Eng.* Sep. 12-4; shops, Mechlin, *The Eng.* Feb. 19-6; slip, imperceptible in, *Ry. Gaz.* Sep. 4-5.

" LOCOMS., SMALL, Buck, *Iron Age*, Aug. 16-3; Krauss, Munich, Dec. 15-7; *Ry. & Eng.* Oct.-7; Dunning, *Ry. Gaz.* June 15-3; May 30-4; (6-inch gauge.) and large, Manchester exhib. *Sci. Am. Sup.* Oct. 15-7; *The Eng.* Sep. 19-4.

" LOCOM. SMOKE-BOX, extension front, function of, *Iron Age*, Dec. 29-7; Mas. Mech. rep. *Ry. Gaz.* July 13-3; and stack, July 10; extended, Wabash, Oct. 30-5; register diaphragm, Concannon, Oct. 7-7.

" LOCOMS., So. Australia, Adelaide & Murray Bridge Ry., Thow, *Eng.* Apr. 15-7; of So. West Ry., '51-'86, *The Eng.* Mar. 11-7; spark arrester, Hill's, *Fran. Inst.* Mar.-3; do. do. *Ry. Gaz.* Feb. 16-3; do. Wilson, *Ry. & Eng.* June-7.

" LOCOM. SPEED, high, *Iron Age*, Mar. 3-7; do. *Ry. Gaz.* Apr. 18-4; do. *The Eng*; piston and train, *Mech.* Apr.-7; project, to Chicago in 18 hours, *Fran. Inst.* June, July-4; *Ry. Gaz.* Feb. 2-3; indicator, Stroudley, *Mech.* Apr. 7-3; do. do. *Ry. Gaz.* Aug. 24-3; recorder, Klose, *Mech.* Mar. 8-4; do. *Eng.* Feb. 1-4.

" LOCOMS., St. German Ry., Paris, tank, *The Eng.* Nov. 27-5; steel in, *Ry. Gaz.* Feb. 5-6; steaming ap., Greenwade, May 20-7; Stephenson wks. *Eng. News*, Nov. 26, 26-7; do. 4-wheel express, pass., Lond. & So. West. *Eng.* Aug. 12, 19-7; Stevens design, express, L. Shore & Mich. So. *Ry. Gaz.* Mar. 11-7; St. Gothard, 8-coupled, Stocker des. *Ry. Gaz.* Mar. 16, 23-3; do. do. *The Eng.* Jan. 5-3; do. *Sci. Am. Sup.* May 12-3; do. Maffel, Munich, *Eng.* Mar. 30-3.

" LOCOMS., STRONG, design, tests, *Eng. News*, Sep. 17, 24-7; *Iron Age*, Jan. 25-3; trials, Sep. 22, Dec. 15-7; valve gear, *Mech.* Jan. 13-3; *Am. Eng.* Feb. 23-7; Lehigh Val. R. *Ry. & Eng.* Mar, Apr, Oct.-7; *Ry. Gaz.* Feb. 5; valve gear, Mar. 19; n. Dec. 10-6; "Duplex," Feb. 18; June 24-7.

RAILROAD LOCOMS., STRONG, tests, rep., Leavitt, *Ry. Gaz.* Sep. 16, 16, 23-7; *Soc. Arts*, Dec. 8-7; *Eng.* Mar. 2-3; radial valve gear, Jan. 15-6; Lehigh Val. R. Apr. 29-7.

" LOCOMS., Swedish Ry., 8-coupled, goods, *The Eng.* Nov. 19, Dec. 3-6; Swiss, Finland Ry., light moguel, *Ry. Gaz.* July 2-6; swivel-bogie 18-inch guage, Chatham Fort wks. *Eng.* Feb. 25-7; do. Inv's exhib. *The Eng.* July 31, Aug. 5-7; Taff Vale Ry., English, tank, Riches, *Eng.* Mar. 13, 27-5; do. do. *Ry. Gaz.* Dec. 25-5; do. repair shops, Cardiff, do. *The Eng.* Sep. 5-4; tank, *Ry. Gaz.* Dec. 25-5; do. *Eng.* Mar. 13, 27-5; do. Black, Oct. 28-7; tender and truck, 3,000 gal., N. Y. West. Sh. & B. *Ry. Gaz.* May 14-6; do. *The Eng.* Dec. 7-3; covering, Chic. & No. West. *Ry. Gaz.* Apr. 15-7; do. No. Brit. Ry. *The Eng.* Sep. 17-6; Thylands Ry., Denmark, Forney, *Ry. Gaz.* Dec. 26-4.

" LOCOM. TIRES, steel, Am. vs. Krupp, *Iron Age*, Dec. 3-5; wear of, Sep. 9-6; ap. for heating, setting and removing, Pedrick, May 12-7; do. *Ry. Gaz.* May 13-7; steel, manuf. July 31-5; turning tools, Ehrhardt, German, June 3; fastenings, June 17-7.

" LOCOM., traction increasers, *Iron Age*, June 9-7; do. trials, Dee, Pitts. Cin. & St. L. *Ry. Gaz.* Aug. 15-4; Am. Ry. Mas. Mech. Assoc. rep. *Locom.* Sep.-7; tractive power, *Ry. & Eng.* Mar.-7; and train resist; effic. of, and water and fuel consump., Frank, *Van Nost.* Mar.-5.

" LOCOM. TRIALS, *Am. Eng.* Oct. 29, Dec. 17-5; Chic. & Alton, Feb. 25, Mar. 4; effic. of bitum. coals, Mar. 4, 11; power of fuel in, Mar. 18; Mich. Cen., Reaser, Apr. 8; power, Aug. 25-6; Bost. & Albany, *Ry. Gaz.* Feb. 2-3; Cen. Pac. Feb. 1-4; do. *Am. Mach*; at high speed, Phil. & Reading, *Ry. Gaz.* Oct. 23-5; Jan. 29-6; C. H. Hudson, *Sci. Am. Sup.* Dec. 4-6; *Eng.* Sep. 18-5; Webb comp. Feb. 1-4.

" LOCOM., Uleaborg Ry. *Eng.* June 4-6.

" LOCOM. VALVE GEARS, radial, Strong, *Mech.* Jan. 13-3; do. *Ry. Gaz.* Mar. 19-6; do. *Eng.* Jan. 15-6; Joy's, *Mech.* Jan. 12-4; do. *Am. Eng.* Aug. 29-4; do. *Sci. Am. Sup.* Oct. 11-4; do. Graham, *The Eng.* Apr. 27; Brown's, June 29-3; Fidler's, *Ry. Gaz.* May 11-3; do. *Eng.* Sep. 24-6; motion, Can. Pac. *Ry. Gaz.* Aug. 12-7; Stevens, *Mech.* July-6.

" LOCOM. VALVES, slide, Allen-Richardson, *Ry. Gaz.* May 9-4.

RAILROAD LOCOM. VALVES, slide, do. Jackson, *Ry. Gaz.* Apr. 1-7; friction, Dec. 31-6; friction ap. May 29-5; do. *The Eng;* Delancey, balanced, Nov. 20-5.

" LOCOMS., Webb's, comp. *Iron Age*, Sep. 6-3; do. *Mech.* Sep. 22-3; do. *Ry. Gaz.* Aug. 17-3; do. tank, Sep. 23-7; do. *Eng.* May 1-5; do. July 1, Dec. 23-7; do. *The Eng.* Aug. 3-3; do. tank, frt., Lond. & No. West. *Ry. & Eng.* Aug.-7; do. *Ry. Gaz.* Feb. 15-4; do. pass. Aug. 21-5; do. Aug. 20-6; do. Dunbar, Nov. 9-3; do. trial, *Eng.* Feb. 1-4; *The Eng.* May 8-5.

" LOCOMS., wheel-base, flexible, Fretel's, *The Eng.* Sep. 26-4; do. *Sci. Am*; wheels, English, *Ry. Gaz.* May 2-4; balancing do. Mar. 16-3; wheel tires, tension of, *Mech.* Jan. 20-3; do. standard, *Ry. Gaz.* Sep. 5-4; whistle, pass. June 5; do. single-bell chime, June 12-5; Wootten fire-box, Phil. & Reading, Feb. 29-4; do. consol., Cul. & Hecla, Jan. 22-6; do. pass. mogul, N. Y. L. Erie & West. Dec. 17-6; do. performance, Apr. 1-7; do. *The Eng.* Dec. 18-5; do. June 3-7; work, standard reamers for, *Fran. Inst.* Sep.-3.

" LOCOM. WORKS, building in U. S., n. *The Eng.* Sep. 21-3; Baldwin, hist. *Iron Age*, Mar. 13-4; do. Aug. 5-6; do. *Mech.* Mar. 1-4; do. locoms. built by, table, *Ry. Gaz.* Mar. 25-7; Clyde. Glasgow, *Eng.* Jan. 8, 15-6; Crewe, Lond. & No. West. *The Eng.* Oct. 3-4; Grt. Northern, Doncaster, *Ry. Gaz.* Oct. 23-5; do. *Eng.* Aug. 7-5; Rogers, *Ry. & Eng.* Jan.-June-7.

" LOCOMS., Wurtemburg, Germany, *Ry. Gaz.* Apr. 20-3.

" MAIL CRANE, Cin. N. Or. & Tex. *Ry, Gaz.* Jan. 21-7; maintenance of way, 40 years, Dec. 18-5; rep. Pitts. & West. Feb. 11-7.

" MANAGEMENT, Transportation, Wellington, *Eng. News*, July 2-7; do. organization for collection of rev. *Ry. Gaz.* July 25-4; do. character of men who handle money, Aug. 8; do. bonding persons who handle money, Aug. 15; do. business, Kirkman, Aug. 22-4; do. retrenchment econ. Apr. 17, 24, May 1-29-5; map, U. S. *Eng. News*, Oct. 8, sup. Dec. 3-7; do. do. lines using Janney coupler, *Ry. Gaz.* Mar. 18-5.

" MASTER MECHANICS ASSOC. pro. *Ry. Gaz.* June 29, repts. July 6, 13-3; pro. June 27-4; June 19, 26-5; June 18, 25, July 2-6; June 24, July 1-7.

RAILROAD MILEAGE, new, U. S., '83, *Eng. News*, Jan. 19-4; do. Canada, Feb. 20-6; operating, block sys. *Ry. Gaz.* Sep. 7-3; do. station records and papers, Kirkman, Oct. 10; do. train and station men manual, Nov. 21-4; op. dept. and management, Dec. 4-18-5; do. Jan. 1-6; op. expenses, U. Pac. June 3-7.

" PASSENGER, fares, surburban, table, *Ry. Gaz.* Sep. 2-7; station, see R. STATIONS, PASS; separating 1st and 2nd class, Nov. 16; and Ticket Agents Assoc. pro. Mar. 30-3; do. Sep. 30-7; traffic and rapid transit, N. Y. *Eng. News*, Apr. 23-7; transport., Am. R.'s, '84, Poor, n. *Locom.* Nov.-5; travel, N. Y. and Chicago, *Ry. Gaz.* Jan. 18-4; handling at crowded terminals, Pearson's device, Sep. 30, Oct. 7-7.

" PATENTS, U. S. *Ry & Eng.* Mar.-7; permanent way, iron and steel, W. R. Browne, *Eng. News*, June 7-4; see also RAILROAD TRACK TIES, METALLIC; pile driver, stm., Hatswell, Flint & Pere M. *Ry. Gaz.* May 9-4; car, stm., Indus. wks. June 19-5; pipe culverts, standard, Kan. C. & Om. *Eng. News*, Oct. 22-7; pool, *Ry. Gaz.* Mar. 21-4; practice, anal. in, *Am. Eng.* Dec. 17-5; prog. in U. S. *Ry. Gaz.* Feb. 18; do. diagram, Paris exten., St. Louis & San Fran. Apr. 15; promotion, July 8-7; pumping, wind eng., Strong's, *Iron Age*, Nov. 1-3; purchasing agent, Kirkman, *Ry. Gaz.* Apr. 1-7.

" RATES, N. Y. R. Coms. rep. *Ry. Gaz.* Dec. 28-3; and charges bill, Brit. Apr. 2-6; receivers, law of, Patterson, Aug. 8-4; repairs, cost, table, Feb. 25-7; repair shop tools, special, Mas. Mech. rep. *Ry. & Eng.* Apr, June, Aug.-7; reservoirs, water wks., for R.'s, mills, farms, *Ry. Gaz.* Nov. 11-7; road bed, standard, Mich. Cen. Mar. 6-5; round h. and repair shops, Rich. & Alleg. Jan. 19-3.

" SAFETY GUARD, Latimer, *Eng. News*, May 21-7; do. appliances, elec. *Am. Eng.* Aug. 31-7; do. econ. value of, *Ry. Gaz.* Nov. 30-3; sand store h., Pitts. Cin. & St. L. Apr. 22; do. and dryer, C. B. & Q. July 22-7; saw, Mich. Cen. Nov. 19-6; screw propeller, Gorman, *Sci. Am. Sup.* July 24-6; section foremen's instructions, *Ry. Gaz.* Apr. 27, May 4-18-3; securities and Vanderbilt's will, Dec. 18-5.

" SHOPS, Am. *Sci. Am. Sup.* Apr. 9-7; Aurora, Ill., C. B. & Q. *Ry. Gaz.* Jan. 7-7; crane, Porter, July 11; notes, Missouri Pac. July 11-4.

RAILROAD SHOPS, at Derby, Midland, England, *Ry. Gaz.* Aug. 22-4; do. *The Eng;* piece wk., Casanave, *Ry. Gaz.* July 2-16, Aug. 6-27-6; repair, special tools in, Mas. Mech. rep. *Ry. & Eng.* Apr. June, Aug.-7.

" SHOVEL, stm., and wrecking car, Bucyrus, *Ry. Gaz.* July 27-3; sidings (turnouts), formula for, Parsons, *Eng. News*, July 19, 26, Aug. 2-30, Sep. 6-4; do. and crossings, standard, *Ry. Gaz*; Dec. 4-5; do. switch, gridiron, Edgehill, Liverpool, Lond. & No. West. Apr. 15-7.

" SIGNAL, crossing, magneto-elec., Penn. Steel Co. *Ry. Gaz.* Aug. 7-5; *Elec. Rev.* May 8-6; elec., decision, Livermore, *Electric.* June-5; opinion Court, June-5; fog and safety ap., Kempe's, *The Eng.* July 15-7; Gould-Tisdale, *Ry. Gaz.* Aug. 19-7; Hall block sys. *Fran. Inst.* Jan.-6; interlocking, Bergen Hill, Penn. R. *Ry. Gaz.* Oct. 14-7; locking gear, Davis, *Eng.* Dec. 4-5; lantern, Metzler, *Fran Inst* Apr.-5; sys., Hadden, *Electric.* May-3.

" SIGNALING, by oil pipes, *Iron Age*, Apr. 8-6; ap., Lond. & No. West. *Ry. & Eng.* Nov. 13-5; by elec., G. W. Blodgett, *Electric.* Dec; Hardy, Dec.-6.

" SIGNALIZER, time, *Fran. Inst.* Jan.-6.

" SIGNALS, aut., Bost. & Albany, *Ry. Gaz.* Jan. 19, Aug. 3-3; do. June 24-7; do. *Sci. Am. Sup.* July 30-7; Inv's exhib. *Eng.* May 1-5; Blackpool, *The Eng.* Oct. 19-3; do. Liverpoo exhib. Dec. 24-6; elec., and interlocking, rep. *Fran. Inst.* Jan.-6; do. imps. in, G. W. Blodgett, *Soc. Arts*, Jan. 22-5; do. N. Y. West Sh. & B. *Electric.* Feb.-5; do. *Eng.* Nov. 21-4; do. Currie's, *The Eng.* Mar. 14-4; electro-aut., Blodgett, *Ry. Gaz.* July 15-7; electro-magnets, working by, Timmis, *Van Nost.* Jan.-5; interlocking and block, Bost. & Albany, *Ry. Gaz.* Aug. 3-3; do. rep. *Fran. Inst.* Jan.-6; interlocked, *Ry. Gaz.* Dec. 17-6; magnetic and teleph. microphone transmitter, *Sci.Am.Sup.* Aug. 8-5; magneto-elec., Penn. Steel Co. Nov. 7-5; *Elec. World*, Dec. 12-5; do. bells, French, May 9-5; photoscope, *Sci. Am. Sup.* Oct. 24-5; pneu., Am. *Ry. Gaz.* Feb. 13-5.

" SIGNALS, Saxby & Farmer safety appliances, *Ry. & Eng.* Sep.-7; do. *Eng.* July 22-7; Shaffer sys. and safety lock, *Eng. News*, Oct. 13-3; semaphore, switch, standard, Cummings, *Ry. Gaz.* May 14-6; do. elec. slot, Nov. 11; do. Johnson's slot, Dec. 30-7; do. Harrington, Oct. 31-4.

RAILROAD SIGNALS, semaphore, do. *Ry. & Eng.* Nov.-7; do. Penn. R. *Ry. Gaz.* Oct. 28-7; Signal and Switch Co.'s exhib., Chicago, July 6; uniformity in, Nov. 9, Dec. 7-3; signal target tests, C. B. & Q. Aug.27-6; torpedo, Palmer, Nov. 20-5; Westinghouse train ap. Sep. 5-4.

" SINGLE TRACK, limit of capac. *Ry. Gaz.* Jan. 18-4; do working, Muir, Feb. 4-7.

" SNOW, fence, cuttings, Howie, *Ry. Gaz.* Oct. 3-4; do. Nov. 26-6; do. *Eng.* Oct. 29-6; flanger, *Ry. Gaz.*Feb. 26-6; do. Chic. Mil. & St. Paul, Feb. 18-7; plow and track flanger, pneu., Mich. Cen. Feb. 26-6; sheds, Can. Pac. *Eng. News*, Oct, 8-7; shovel, rotary stm. *Ry. Gaz.* Sep. 12-4; do. Apr. 24-5; do. do. Feb. 25, Apr. 22-7; do. do. *Eng.* Oct. 17-4; specs. *Sci. Am. Sup.* Sep. 15-3; do. *Eng. News.*

" SPEED INDIC., Stroudley, *Ry. Gaz.* Nov. 7-4; do. *Eng.* Feb 23; do. Tinkbein, Jan 19-3; recorder, Russia, Jan. 30-5; do. Siemen's, *Ry. Gaz.* Apr. 22-7.

" SPEEDS, high, *Iron Age*, Oct. 7-6; *Eng. News*, Oct. 6-3; fast Am. Aug. 22-5; Oct. 23-6; *Sci. Am. Sup.* May 31-4; table, *The Eng.* Aug. 7-5; English, *Iron Age*, Jan. 10-4; fast trains of world, July 9-5; express, tables, Foxwell, *Sci. Am. Sup.* Jan. 26-4; high, *Mech.* Sep. 1-3; May 24-4; *Ry. Gaz*; fastest in world, table, *Mech.* July-5; train recording, *Am. Eng.* Feb. 20; fast trains, Brit. vs. Am. May 1-5; table, *Eng.* Aug. 14-5; *Van Nost.* Feb, n. Sep.-3; train speed and power, Schoeffler, Feb; fast trains, Europe and Am., Rotch, May-3; *Sci. Am. Sup.* Jan. 13-3; do. *The Eng.* Jan. 26-3; and facilities, Le Van, *Sci. Am. Sup.* May 2-5; fast time, *Fran. Inst.* Apr.-5; fast trains, *Ry. Gaz.* Jan. 5; do. conditions, Jan. 19; do. U. S. Mar. 2, 23; do. English, Aug. 17-3; do. do. express, *Eng.* May 23-4; fast, New O. & Tex. *Ry. Gaz* Mar. 7; do. table, June 6, 13; do. Chic. to Wash., Balt. & O, June 20-4; fast trains, English and Am. May 1, Sep. 4; do. N. Y. W. Sh. & B. July 17, Aug. 28-5; English, *The Eng.* Oct. 26-3; fastest in England, Feb. 29, n. Mar. 14-4; *Sci. Am. Sup.* June 7-4; English express, Willock, *Locom.* Jan.-5.

" SPIRALS, *Ry. Gaz.* Nov. 27-5; spikes, strength of, Apr. 2, 9, 23; springs, Farrel's bandless, Dec. 31-6.

" STATIONS, Battle Creek, specs,, *Eng. News*, Sep. 24, Oct. 22-7.

RAILROAD STATIONS, foot bridge, Arrol Bros., Scotland, *Ry. & Eng.* Mar.-**7**; pass., Glen Ridge, Del. Lack. & W. *Ry. Gaz.* Apr. 29; do. Jersey City, N. Y. L. Erie & West. May 6-**7**; do. do. *Eng. News*, May 29-**6**; do. Mich. Cen. Sep. 10-**7**; do. Kalamazoo, *Ry. Gaz.* Aug. 5-**7**; do. Milwaukee, *Eng. News*, Mar. 5-**7**; do. Munich central, *Ry. Gaz.* Dec. 30-**7**; do. platforms, standard, Penn. & O. July 17; July 3-**5**; Powell, Phil. Ger. & Chest. Hill, Nov. 26-**6**; Eastern & Midland, Marriott, *Eng.* Jan. 28-**7**; N. Y. W. Sh. & B. *Ry. Gaz.* Apr. 23, May 7-**6**; pass., Ann Harbor and Dexter, Mich. Cen. Apr. 1-**7**; do Un. Pac. *Eng. News*, Apr. 2-**7**; do. *Am. Arch*; and yards of double track lines, *Ry. Gaz.* Apr. 24, 31-**3**; Terrace Park, Buffalo, N. Y. Cen. *Ry. & Eng.* May-**7**.

" STATISTICS, '82, *Iron Age*, Aug. 23-**3**; do. Aug. 7-**4**; do. U. S. *Mech.* Feb. 24-**3**; do. traffic, and the year, *Ry. Gaz.* Dec. 31-**6**; steel tires manuf. *Iron Age*, Aug. 13-**5**; stock fluctuations, and eng. compared, *Ry. Gaz.* July 18-**4**; stops at crossings, cost of, Jan. 12-**3**; supplies, handling, Kirkman, Feb. 11, Apr. 15-**7**.

" SWITCHES, ap., Dujour, *Ry. Gaz.* Jan. 25-**4**; curves, May 14-**6**; cut-out, Dailey, May 20-**7**; and frogs, Parsons, *Eng. News*, May 10-**4**; interlocking, *Ry. Gaz.* Dec. 28-**3**; do. Sep. 19-**4**; do. Mar. 13; do. tables, Nov. 20; and signals, do., Saxby, Grand Cen. depot, N. Y. Mar. 13-**5**; theory of, Stephens, *Van Nost.* Aug.-**3**; unguarded, *Ry. Gaz.* Aug. 17-**3**; and frog foot-guard, *Ry & Eng.* Sep.-**7**; frog, German, *Ry. Gaz.* Sep. 11; frogless, Price, Sep. 18; Mansfield, Sep. 25-**5**; do. main track, Price, *Am. Eng.* Nov. 5, 12-**5**; and frog rules, *Ry. Gaz.* Oct. 26, Nov. 30, Dec. 7; frogs, July 20, 27, Aug. 3, 31, Sep. 7-**3**.

" SWITCHES, lock, Mitchell, *Ry. Gaz.* Sep. 16; do. Kirby, Nov. 18-**7**; locking gear, Langley, Mar. 11-**7**; do. *Eng.* Feb. 18-**7**; points, Barr, *The Eng.* Mar. 4-**7**; sidings, gridiron, Edgehill, Liverpool, Lond. & No. West. *Ry. Gaz.* Apr. 15-**7**; and signal ap., interlocking, tables, Sep. 19-**4**; split, guard, Mansfield, Dec. 9-**7**; stand, Chic. exhib. Dec. 21-**3**.

" TELEGRAPH. See RAILROAD TRAIN TELEGRAPHING.

" TERMINAL FACILITIES, N. Y., Del. Lack. & W. *Ry. Gaz.* Oct. 16; N. Y. Cen. Jan. 23, 30, Feb. 6; N. Y. L. Erie & W. Sep. 4-**5**.

RAILROAD TERMINAL FACILITIES, N. Y. W. Sh. & B., Weehawken, *Eng. News*, Sep. 29-3; do. *Ry. Gaz.* Nov.-6; do. Penn. R. Feb. 20, 27; Boston, May 15-5; yards and wks., Buffalo, Jan. 8, 8-6; terminus, N. Y. W. Sh. & B. and N. Y. Ont. & West. *Sci. Am. Sup.* Apr. 21-3; timber consump. *Iron Age*, Sep. 2-6; do. *Pop. Sci. M*; do. preserv. experience, *Ry. Gaz.* Jan. 12-3.

" TIME, bk. *Ry. Gaz.* Jan. 21-7; standard, *Eng. News*, Oct. 20, Nov. 10-3; indic., Dumont, *Ry. Gaz.* Nov. 23-3; rules and teleg. orders, rep. Oct. 22-6; table making, *Eng. News*, Sep. 29-3; do. *Mech.* Sep. 22-3; tables, *Ry. Gaz.* Oct. 26, Nov. 2-3; do. typography, Apr. 1-7.

" TRACK, Parsons, *Eng. News*, Oct. 4–Dec. 27-4; do. Jan. 3–Oct. 17-5; Sweeney, *Ry. Gaz.* Mar. 11-7; Dudley, *Soc. Arts*, Apr. 28-7; Inv's exhib. *Eng.* Oct. 9-5; Vogdt's, *The Eng.* Apr. 30-6; angle bar breaks, Weiss, *Ry. Gaz.* Jan. 14-7; ballast, importance of, Burkhardt, *Eng. News*, Oct. 16-6; buckling under suns heat, Greenhill, *The Eng.* July 8-7; buffer, Shaw, *Ry. Gaz.* Sep. 19, 26; clearing from snow in cuts (fences), Oct. 3; crossing curve, n. Oct. 17-4; drainage, July 10-5; fishplate, defects of, Sep. 3-6; frog foot-guards, Hart, May 9-4; frogs, guard rails, etc., tables, June 27-4; gauge, Willard, Nov. 11-7; gauges and wheel flanges, N. E. R. Club, Apr. 23; inspections, Sav. Fla. & West. Aug. 20-6; do. stm. car, Merryweather, *Eng.* Jan. 28-7.

" TRACK, joints stat., U. S. *Ry. Gaz.* Dec. 5-4; laid in U. S., '82, *Eng. News*, Jan. 27, Feb. 3, 10-3; laying, joints on curves, *Ry. Gaz.* Apr. 6-3; do. mach. *Sci. Am. Sup.* Aug. 27-7; lifting jack, German, *Ry. Gaz.* May 20; (per. way), Lond. & No. West. July 8-7; maintenance of way, Treadwell, *Am. Eng.* Aug. 27, Sep. 3-5; do. as affected by traffic, *Ry. Gaz.* Dec. 4-5; materials, Kirkman, Apr. 29-7; metallic, see R. TRACK TIES, METALLIC; safety guard pat., Latimer, *Eng. News*, May 7-7; signs, standard, N. Y. Penn. & O. *Ry. Gaz.* May 23-4; specimen, fine, *Eng. News*, Sep. 17-7; spike, Penn. R. *Ry. Gaz.* Dec. 4-5; standard, N. Y. L. Erie & W. June 3-6; sun kinks, *Mech.* Oct.-4.

" TRACK TIES, *Eng. News*, Aug. 4, Dec. 29-3; *Ry. Review*; *Ry. Gaz.* Apr. 10-5; Am., standard dimens; *Eng. News*, Jan. 17-5; do. *Ry. Gaz.* Dec. 26-4; beechwood for, *Eng. News*, Apr. 3-6; chestnut oak for, n. *Ry. Gaz.* Dec. 16-7.

RAILROAD TRACK TIES, creosoting ap., Chaligny's, *Sci. Am. Sup.* Nov. 21-**5**; durability, *Eng. News*, Aug. 29-**5**; Hough rep. June 27-**5**; of Florida oak, *Am. Eng.* Apr. 22-**6**; on French Rys., consump. of, *Eng. News*, Feb. 28-**5**; and forest destruction, *Ry. Gaz.* Feb. 16-**3**; Ill. Cen., tie and rail renewals, Apr. 2-**6**; length of, *Eng.* June 17-**7**.

" TRACK TIES, METALLIC, Legrand, *Eng. News*, Jan. 15, 29, Feb. 5-**7**; Tratman, Feb. 12-**7**; iron, in Germany, Jungbecker, Mar. 8-**4**; do. May 30; Holland, June 13-**5**; in Europe, Apr. 24-**6**; Post's, *Sci. Am. Sup.* Nov. 14-**5**; do. *The Eng.* July 22; Quelch's, Dec. 30-**7**; June 12-**5**; iron and steel in Europe, *Iron Age*, Apr. 29-**6**; do. Browne, *Ry. Gaz.* June 13-**4**; *Am. Eng.* Mar. 13-**5**; steel, Oct. 20-**6**; cast iron sleeper, N. Y. Cen., Toucey, *Ry. Gaz.* Sep. 4-**5**; iron vs. wood, German, Meyer, Feb. 19-**6**; iron, expt. June 4, 4, 11-**6**; do. Post, Sep. 9-**7**; composite ties, Austin, Seidl, Dec 9; cost of maintenance, Dec. 16-**7**; steel sleepers, Post, *Van Nost.* Aug-**6**; do, Midland Ry., England, *Ry. Gaz.* Jan. 8-**6**; Lond. & No. West. Apr. 13-**3**; do. Webb's, *Sci. Am. Sup.* Oct. 4-**4**; do. *Eng.* May 1-**5**; do. Netherlands State Ry., Braet, *Ry. & Eng.* Aug; do. on European Rys. Nov.-**7**; iron and steel, German, *Eng.* Feb. 26-**6**; steel, Hoerde, Aug. 12-**7**; Taylor, *The Eng.* Feb. 25-**7**; on German Rys. June 4-**6**; do. Sheffler sys. June 25-**6**.

" TRACK TIES, preserv. *Eng. News*, Dec. 27-**4**; *Ry. Gaz.* Feb 19-**6**; Aug. 19-**7**; by antiseptics, Card, *Ry. & Eng.* Sep.-**7**; *Sci. Am. Sup.* Aug. 20-**7**.

" TRAFFIC, U. S., '83, *Ry. Gaz.* Dec. 28-**3**; and U. S. exports and imports, Feb. 5-**6**; growth of agric. and other, May 18-**3**; wts., anal. *Am. Eng.* Feb. 11-**6**; Chicago shipments, *Ry. Gaz.* Jan. 26; receipts and No. West. productions, Feb. 23-**3**; cost of transport. Oct. 21-**7**; crops, June 15; do. development, Mar. 2-**3**; haul, graph. det. of dist. of, *Eng. News*, Apr. 14-**3**; hog packing in Northwest, *Ry. Gaz.* Mar. 16; as affected by iron indus. June 15; lumber, June 15-**3**; pass., Pac. Coast, May 28-**6**; see also under names of cities; safety of travel. *Eng. News*, Oct. 3-**5**; stat. *Ry. Gaz.* Dec. 31-**6**; traffic union, German, Nov. 18-**7**.

" TRACTION, draw-bar, C. B. & Q. *Eng. News*, May 14-**7**.

" TRAIN, cost of running, *Mech.* May 10-**4**; despatchers diags. *Ry. Gaz.* July 13-**3** &c.

RAILROAD TRAIN, elec. continuous, *Sci. Am. Sup.* Aug. 13-7; frt., long, Louis N. Or. & Tex. *Ry. Gaz.* Dec. 11-5; *Locom.* Apr.-6; indic., Boynton's, G. W. Blodgett, *Soc. Arts*, Apr. 9-5; lamp, Watts', *Ry. Gaz.* Dec. 25-5; lighting by elec., Blodgett, *Ry. & Eng.* Oct.-7; do. expt., Massey, *Elec. Rev.* June 21-4; elec. lighting, *Elec. World*, Dec. 5-5; G. W. Blodgett, July 9-7; *Eng.* Dec. 5-4; movement by teleg., Turner, *Ry. Gaz.* Jan. 15, 29, Feb. 5-26-6; orders, and rules, uniform, July 3-5; telegraphic, Apr. 22, 29-7; pipe indic., West. Brake Co., Kapteyn, *Eng.* Oct. 9-5; President's, *Sci. Am. Sup.* Oct. 29-7; pullman, from Calais to Rome, *Ry. Gaz.* Apr. 6-3.

" TRAIN RESIST., tests, *Eng. News*, Dec. 10-7; *Sci. Am. Sup.* Oct. 6-3; and journal friction expts., Wellington, *The Eng.* June 26-5; do. *Ry. Gaz*; and tractive power, Galloupe, *Am. Eng.* Dec. 3-5; and locom. tests, Jan. 21, 28-6; curve, Trautwine, *Ry. Gaz.* Feb. 1, Mar. 14-4; do. as affected by length of train, Oct. 9-5; *Van Nost.* Aug.-3; *The Eng*; do. compensation for, Randolph, *Van Nost.* Mar.-4; do. as an element of danger, Mackensie, Jan.-4; resist. expts. *Ry. Gaz.* Mar. 12; do. Hudson, Mar. 26-6; *Van Nost.* Mar.-6; resist., winter and summer *Ry. Gaz.* Apr. 9; tests, Burlington, Nov. 19-6; resist., M. C. B. rep. June 17-7; *Locom.* Aug.-7; and tractive power, *Ry. Gaz.* Dec. 30-7; Desdouits, *Ry. & Eng.* Feb; M. C. B. rep. July-7; due to grav. on inclines, table, *The Eng.* sup. July 23-6.

" TRAIN rules, *Ry. Gaz.* May 11, 18, June 1-29, July 6-27-3; Mar. 25-7; and teleg., uniform, rep., May 8-5; in 1845, Mar. 12-6; running, cost of, *Eng. News*, Mar. 29-4; service, Am. and foreign, Hadley, *Ry. Gaz.* Nov. 25-7; signal, elec., Acme, *Elec. Rev.* Aug. 6-7; signaling ap., aut., Ducousso's, *Sci. Am. Sup.* Apr. 14-3; *Eng.* Jan. 5-3; Suyer's, *The Eng.* Oct. 22-6; speeds, rule for, Steiner, *Eng. News*, Mar. 29-4; n. Sep. 18-6.

" TRAIN TELEGRAPHING, Phelp's elec. induction, *Ry. Gaz.* Feb. 20, n. Apr. 10-5; Sep. 16-7; do. from morning trains, *Fran. Inst.* Sep.-5; do. on moving trains, July-6; *Electric.* Oct.-3; Phelp's induction, from moving trains, n. Mar-5; Aug.-7; do. sys., expts. *Elec. Rev.* Feb. 21-5; by induction, Lehigh Valley, Sep. 24, Oct. 15-7; with moving trains, *Elec. World*, Feb. 21, Dec. 5-5; Edison's sys., Phelps, Mar. 6-6.

RAILROAD TRAIN TELEGRAPHING, duplex, *Elec. World*, Nov. 13-6; Lehigh Valley, Sep. 24-7; to moving trains, Rudd, *West. Electric.* Dec. 3-7; *Sci. Am. Sup.* Dec. 3-7. See also RAILROAD TELEGRAPH.

" TRAIN weights and speeds, frt., n. *Eng. News*, Sep. 18-6; wrecks, managing, *The Eng.* June 29-3; *Nat. Car Bu*; trains, frt., long, Louisville N. Or. & Tex. *Eng. News*, Dec. 19-5; *Ry. Gaz.* Dec. 11-5.

" TRAVELERS risks, Bly, *Eng. News*, July 25-5; traveling in 1849, *Ry. Gaz.* Aug. 3; tunnel wk., Pittsburg, Aug. 24-3; turntable, wooden, *Eng. News*, Feb. 24-3; wrt. iron, Lowthorp, Apr. 2-7; do. and eng., Altoona, Penn. R. *Mech.* Jan. 19-4; *Eng.* July 13-3; and sand house, Del. Lack. & West., Hoboken, *Mech.* Dec.-4; do. Fritzsche, *Ry. Gaz.* Feb. 9-3; turntables, Indian State Rys. *The Eng.* Oct. 28-7; watchmans shanty, *Eng. News*, Aug. 8, 15-5; water column, Poage, *Ry. Gaz.* Sep. 21; water crane, Penn. R., Collin, Aug. 24-3; do. crane, White, Mar. 7-4; Indian State Rys. *The Eng.* Oct. 7-7.

" WHAT constitutes a, *Ry. Gaz.* July 31-5; whistles, expts. Aug. 24, 31-3; wrecking and stm. shovel car, Barnhart, Feb. 13-5.

RAILROADING, elements of, drainage, *Ry. Gaz.* Nov. 7-4; locoms., Paine, Dec. 26-4; pass. movement, Jan. 16; frt. Jan. 9, cars, Jan.2-5; real estate, records, etc. Nov. 14: shops, eng h. Dec. 12; stations, Nov. 21; teleg. fences, Dec. 19; track, main and sidings, Dec. 5-4; scientific, J. H. Wilson, Dec. 30-7.

RAILROADS, including reports of North American R. R's. See RAILWAYS, for foreign lines. See also *Ry. Gaz.* files, *Eng. News* files, for news items and construction notes.

" OF WORLD, *Iron Age*, Mar. 5-5; July 15-6; Trasenster, *Eng. News*, Feb. 28-5; *Mech.* Jan. 6-3; *Ry. Gaz.* June 4-6; June 3-7; *Van Nost.* Mar.-3; prog., table, *Iron Age*, Jan. 11-3; stat. *Eng. News*, Mar. 7-5.

" U. S., progress of, chart, *Ry. Gaz.* Feb. 18-7; transcontinental, from French standpoint, *Eng. News*, Mar. 14-5; *Sci. Am. Sup.* Dec. 17-7; Western Assoc., rep. *Ry. Gaz.* Jan. 19-3; in 1830, *Eng. News*, Sep. 29-3; Am., in 1840, *Iron Age*, Sep. 16-6; early Am. *Sci. Am. Sup.* Sep. 15-3; 1880, complete census stat. *Ry. Gaz.* Feb. 9-3.

RAILROADS, U. S. '82, Poor's Manual, *Eng. News*, Sep. 8-3; review of, *Ry. Gaz.* Aug. 17, table, Aug. 24-3; '83, Aug. 1-4; '84, Poor, *Eng. News*, Oct. 4-4; table, *Ry. Gaz.* Aug. 7, 28-5; '85, Poor's rep. Aug. 13-6; '86, Aug. 26; '87, Dec. 30-7.

" ALA. N. OR. TEX. & PAC. J. *Ry. Gaz.* Feb. 15; Atch. Top. & S. Fe. Feb. 8-4, May 13, 13-7; do. fluctuations in maintenance expenses, Sep. 12-4; Boston, value of, n. Mar. 27-5; do. suburban traffic, May 4-3, n. Dec. 11-5; Bost. & Albany, Nov. 2-3; do. Dec. 4-5; do. Nov. 4-7; Bost. & Maine, Mar. 30-3; do. Dec. 3-6; do. Dec. 16-7; Bost. & Prov., rep. Nov. 19-6; Bost. Revere B. & Lynn (narrow g.), rep. Feb. 9; Balt. & O., organization, Mar. 16-3; reps. July 13-3; do. Nov. 21, 28-4; do. Nov. 19, 19-6; do. hist., n. *Eng. News*, Sep. 17-7.

" CANADA, *Ry. Gaz.* May 1-5; Grand Junction, *Eng.* Jan. 19-3.

" CAN. PAC., track laying in '82, Bell, *Eng. News*, Mar. 17; Dec. 29-3; west. div., J. C. James, Nov. 1-15-4; do. location, *Am. Eng.* Aug. 13, 20-5; shops, *Iron Age*, Oct. 4-3; *Ry. Gaz.* Apr. 20-3; contractors, *Eng. News*, Feb. 16; division of land on, Aug. 23-4; rep. *Ry. Gaz.* July 11-4; snow slide region, Schenck, Jan. 22-6; rep. May 27, 27-7; *Sci. Am. Sup.* July 24-6; Nov. 5-7; *Eng.* Mar. 21, 28, Apr. 4, 25, May 16-30, June 6-27, July 4, 11, 25, Aug. 1-29, Sep. 5, 19-4; west. terminus, map, July 8-7; *The Eng.* Nov. 6-5; rapid construct., Abbott, *Eng. News*, Mar. 28-5; *Am. Eng.* Apr. 3-5; *Ry. Gaz.* Nov. 26-6.

" AND CANALS, *Mech.* Sep. 29-3; Central, U. S. *Eng. News*, Nov. 3, 10-3; do. & Banking Co., Ga., rep. *Ry. Gaz.* Dec. 18-5; Chesapeake & O., rep. Apr. 23-6.

" CHICAGO, earnings, *Ry. Gaz.* Apr. 10-5; extensions, *Eng. News*, Sep. 10-7; mileage and receipts, *Ry. Gaz.* Oct. 16-5; & Atlantic, Nov. 7-4; & Alton, rep. Mar. 2-3; Feb. 27-5; Mar. 19-6; Mar. 4-7; Bur. & Q. rep. Jan. 5, Apr. 20-3; May 7-6; and Cleveland, between, hist., Sargent, Sep. 30-7; Milwaukee & St. P. Apr. 27-3; '83, Feb. 1, rep. Mar. 28, 28-4; do. Mar. 20-5; & No. West. Aug. 17-3; Aug. 15-4; rep. July 31-5; Aug. 6-6; Aug. 12, 12-7; Rock Is. & Pac., rep. July 14-4; June 11, 18-6; June 17-7.

RAILROADS, CIN. Ind. St. L. & Chic., rep. *Ry. Gaz.* Oct. 7-**7**; Cin. New Or. & Tex. Pac. and organization, Feb. 23; Cleveland Col. Cin. & Ind. Mar. 23-**3**; stock div. rep. Apr. 25-**4**; Conn. Commis. rep. *Eng. News*, Feb. 2-**4**; and crops, *Ry. Gaz.* Sep. 21-**3**.

" DATES of introduction in various countries, *Eng. News*, Mar. 6-**6**; do. *Elec. Rev.* Apr. 24-**6**; do. *The Eng.* Apr. 30-**6**; Del. Lack. & West. *Ry. Gaz.* Jan. 18-**4**; do. origin, July 11-**4**; do. N. Y. terminal wks. Oct. 16-**5**; Denver & Rio Grande, May 23-**4**; early objections to, Feb. 23; Eastern (Mass.), Oct. 5-**3**; East Tenn. Vir. & Ga. Dec. 12-**4**; do. Dec. 2-**7**; electricity on, bks. Aug. 31-**3**.

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" ST., N. Y. traffic, n. *Eng. News*, Dec. 31-**7**; *Ry. Gaz.* Dec. 14-**3**; (State), *St. Ry. Gaz.* July; N. Y. Assoc. pro. Oct.-**7**; Paris, Apr.-**6**; pneu., compressed air, San Fran. *The Eng.* Sep. 26-**4**.

" ST., rail and track (Liverpool), *Eng. News*, Aug. 20-**7**; Cregier rail, *St. Ry. Gaz.* Mar; rails, center bearing, etc. May; rails, Am. Assoc. Nov.-**7**; do. best material for, Wright, *Sci. Am. Sup.* July 25-**5**; rules, Rodgers, *St. Ry. Gaz.* Dec; sandbox, Car Track Friction Appliance Co. Mar, July-**7**; station and waiting room heating, June-**6**; stm. traction, Sep; stm. motors, noiseless, Nov.-**6**; car, Baldwin, *Sci. Am. Sup.* Feb. 2-**4**; do. *Ry. Gaz*; stm., Liege, *The Eng.* Aug. 17-**3**; stm. working, Parsons, Dec. 12-**4**; do. Birmingham, Mar. 18-**7**.

" ST., St. Etienne tramway, *Sci. Am. Sup.* Jan. 24-**5**; strikes, N. Y. City, *St. Ry. Gaz.* Mar, Apr.-**6**; do. Oct; success of, June-**7**; switches, Scott's tramway points, *Eng.* Aug. 31-**3**; see also RYS., ST., construction, etc., Wright; track ties, iron, Paris, *Eng. News*, Aug. 30-**4**; traffic, city, Galloupe, Oct. 1-**7**; do. rapid transit facils., N. Y. and Boston, *St. Ry. Gaz.* July; tramway, origin of word, Apr.-**7**; for tramways, see RYS., STREET; travel, rapid transit facils., N. Y. and Boston, Galloupe, *St. Ry. Gaz.* July-**7**; do. city traffic, *Eng. News*, Oct. 7-**7**; Vienna City, *The Eng.* Mar. 16-**3**.

" SUAKIM-BERBER, *Am. Eng.* Mar. 20-**5**; switches, points and crossings, E. Bengal, *The Eng.* Feb. 9-**3**; interlocking points, Dutch Ry. Co. Feb. 19-**6**; see also R. SWITCHES; in Sweden, n. *Ry. Gaz.* Oct. 8-**6**; do. *Eng.* July 15-**7**; in Switzerland, Aug. 6-**6**; see also RYS., ST. GOTHARD; tip wagon, Fowler, *Eng.* Oct. 9-**5**; 6-ton, English, Oct. 29-**6**; wagons, metre gauge, *The Eng.* June 27-**4**; travel, classes and fares in Prussia and Am. *Ry. Gaz.* Apr. 11-**4**.

" UNDERGROUND subways, water tight bulkheads for, J. E. Robinson, *Eng. News*, Jan. 8-**7**; *San. Eng.* Mar, May 20, 27, June 3; in cities, July 8; problem in N. Y. City, July 15; Aug. 26-**6**.

RAILWAYS, UNDERGROUND, vs. elev. *Ry. Gaz.* Feb. 18; pass. traffic, May 6-7; Glasgow, n. Feb. 5-6; London, Met., subsidence of, Hutchinson rep. *San. Eng.* Mar. 11; May 20, 27, June 3-6; traffic, *Ry. Gaz.* Feb. 18-7; Parks, *Eng.* Mar. 21; Met. extension, June 6, 13-4; Met. and Met. District, Baker, Feb. 20-5; Met. inner circle completion, Hawkshaw, eng. *The Eng.* Mar. 2, 9-3; inner circle, July 2-6.

" UNDERGROUND, London & Southwark subway, Greathead, eng. *Eng. News*, Nov. 5-7; *St. Ry. Gaz.* July-7; *Eng.* Apr. 1, 15-7; *The Eng.* Oct. 7-7; N. Y. city, Arcade, Broadway, *Eng. News*, May 12-3; District, *Mech.* Feb.-6; problem in, *San. Eng.* July 15-6; *St. Ry. Gaz.* Apr.-7; do. *Ry. Gaz.* Jan. 1-6; do. May 6-7; District, *Eng. News*, Jan. 2-6; do. *Ry. Gaz.* Jan. 1-6; do. *St. Ry. Gaz.* Jan.-6; do. *Elec. World*, Jan. 9-6; do. *Eng.* June 4-6; Met. *Ry. Gaz.* May 6-7; Phil. Met. Oct. 15-6.

" VENEZUELA, of, *Iron Age*, Sep. 20-3; do. Guaira and Caracas, *Eng.* Oct. 9-5; wagons, Cawnporea Ry. *The Eng.* July 31-5; do. Indian State Rys. July 1-7; see also RYS., tip wagons; wire, Ball, *Sci. Am. Sup.* May 28-7; wrecking plant, Grt. So. & West., England, *Ry. Gaz.* July 17-5; do. *The Eng.* Apr. 3-5; working, *Eng.* Feb, 23-3; works, Granile, at Naples, Med. Ry. Co. *The Eng.* Dec. 23-7.

RAMIE decorticating mach. *Sci. Am. Sup.* Nov. 13-6.

RAWLINSON, ROBERT, *The Eng.* Aug. 17-3.

REFRIGERATING, freezing mixtures, table, *Sci. Am. Sup.* Dec. 5-5; do. Aug. 27-7; by ammonia proc. *Am. Eng.* June 3, 10-6; ap., ammonia, *Eng.* July 22; ap. test, N. Y. July 22-7; mach., ammonia, Am., Wood, *The Eng.* Feb. 4-7; cold air, *Eng.* Apr. 25-4; compressed air, W. Anderson, *Sci. Am. Sup.* Aug. 22; different methods of producing cold, artificially, Coleman, Aug. 23-4; mechan. production of, Sep. 19-5; and ice, Ballentine, *Am. Eng.* Aug. 22-4; Chamber's, *The Eng.* Aug. 14-5; ice making, handy, Fleuss', July 8-7; cold air, Giffard's, July 6, Aug. 17-3; do. Hall's, *Sci. Am. Sup.* June 28-4; do. *Eng.* June 27-4; do. *The Eng.* May 23-4; hand ice making, *Sci. Am. Sup.* Aug. 6-7; and compressed air, Kirk, *The Eng.* Apr. 4-4; and ice making, Lightfoot, des. *Sci. Am. Sup.* July 17, 24-6; do. *The Eng.* Feb. 16-3; do. dry air, May 16-4; do. May 21, 21, June 4, 25-6; do. and Otto gas eng., Crossley, Feb. 25-7.

REFRIGERATING, and ice making, Pictets' ice, *The Eng.* Nov. 30-3. See also ICE MACH.

RESPIRATORS, for smoke and gases, Loebs, *Sci. Am. Sup.* Sep. 24-7.

REVOLVER, Kynoch, *Eng.* Jan. 15-6. See also GUNNERY AND ARMOR.

REIS, PHILIP, Buck, *Electric.* Sep.-3; por. *Sci. Am. Sup.* Oct. 31-5.

RESIN indus. in Landes dept., France, Renard, *Sci. Am. Sup.* July 5-4.

RICHARDSON, H. H. *San Eng.* May 6-6.

" WM. J., por. *St. Ry. Gaz.* Mar.-6; do. Jan.-7.

RIKER'S Is. improvement, *Eng. News*, Dec. 26-5.

RIVERS, Atchafalaya, La., founding piers in, *Eng. News*, May 5-3; bars, removal of, Aus., Shellshear, *The Eng.* Jan. 23-5; cabling, Macquarrie, *Elec. World*, June 26-6; Cal. mining debris in, Bowie, *Eng. News*, July 30-7; crossings, Coats, *Am. Eng.* Feb. 2-7; current meters, *The Eng.* May 9-4; Danube, obstruction removal, near Vienna, Specht, *Eng. News*, July 12-4; origin and removal of, do. Gartner, *Van Nost.* Feb.-5; Delaware, tidal, imp., Haupt, *Fran. Inst.* Oct.-7; denudation by, *Van Nost.* July-4; do. *The Eng*; estuaries, Carver, *Am Eng.* May 1-5; W. R. Browne, *The Eng.* Nov. 14-4; in Europe, inland nav. of, Hartley, *Van Nost.* Aug. Sep.-6; *Eng.* Apr. 24-5; flooding the Sahara, Plympton, *Van Nost.* Aug.-6; *Science*; floods, Ohio, Merrill, *Eng. News*, Mar. 22, Apr. 5-4; and water way, regulation for prevention of, Wex, *Van Nost.* Feb.-3; flow of streams, Maw, *Sci. Am. Sup.* Dec. 20-4; do. *The Eng.* Oct. 17-4; and harbors, U. S. Engs. rep., Overman, *Am. Eng.* Aug. 6, 13-5.

" HUDSON, *Eng. News*, July 12; and Harlem connection, Newton, Aug. 30-4; Humber, tidal, *Van Nost.* May-5; *Eng.* Dec. 12-4; hydrometrograph, Ravaglia's, (water level aut. indic.) *Elec. World*, Aug. 15-5; do. *Sci. Am. Sup.* Oct. 3-5; Jetty sys. *Eng. News*, Feb. 3-3; Kanawha, Aug. 28; do. lock and dam, Nov. 20-6; do. *Eng. & Bu. Rec.* Oct. 22-7; improvement, Japanese, *Am. Eng.* Mar. 11, 11, 18-6; Levee sys. May 8, 29, July 30, Aug. 6, 27, Sep. 10-5; and harbor, N. Y. and N. J., Gillespie, Aug. 13-5; U. S. Aug. 10, 31; Mississippi, rep., Miller, *Eng. News*, July 28-3.

RIVERS, imp., *Ry. Gaz.* Apr. 22, 29, May 6; Talmage, June 24-7; *Sci. Am. Sup.* Aug. 6-7; Peoria, Ill. *Am. Eng.* Oct. 5, 12; Seine, *Sci. Am. Sup.* Sep. 10-7; western waterways, construct. *Am. Eng.* Oct. 26-7; Lake tributaries, mouths of, Rice, *Van Nost.* Dec.-3.

" MISSISSIPPI, floods, *Eng. News*, July 7-3; do. *Eng.* May 23-4; imps. rep., Miller, *Eng. News*, July 28-3; do. *Ry. Gaz.* Apr. 22, 29, May 6; do. Talmage, June 24-7; do. *Sci. Am. Sup.* Aug. 6-7; jetties, So. Pass, cost, *Eng. News*, Dec. 17-7; levees, rep. Aug. 7-6; do. *Am. Eng.* Feb. 9-7; reservoir sys. at head of, *Eng. News*, Aug. 23-4; do. Pyle, *Harpers*, Sep.-4; silt movement, McMath, *Van Nost.* Jan.-3; source, L. Itasca, *Sci. Am. Sup.* Feb. 19-7; valley, protection from overflow, J. B Robinson, *Am. Eng.* Aug. 8-22-4; work on, *Eng. News*, Nov. 14-5.

" MOTOR, Nossian's, Maier, *Sci. Am. Sup.* July 2-7; mt. streams, sediment carrying, in Europe, Specht, Dec. 12-5; Niagara gorge and falls, Hovey, Sep. 11-6; Nile delta, Wanderson, *Am. Eng.* Aug. 1-4; do. Anderson, *Van Nost.* Sep.-4; do. *Eng.* July 4-4; expedition from Khartoum to sea, map, *Sci. Am. Sup.* Oct. 18; do. and nav. Dec. 6, 6-4; floods, impounding, map, Oct. 24-5; do. *Eng.* Sep. 11-5; physics, problems, J. B. Johnson, *Eng. News*, Aug. 1-5; do. *Van Nost.* Sep.-5; purification, peaty, self-purification, Hartley, *Van Nost.* July-3; Thames, *Eng.* Aug. 21-5; Rhine wire rope towage, *Sci. Am. Sup.* July 19-4; Rhone, moveable weirs on, *Eng. News*, Apr. 14-3; do. Lyons, *Eng.* Mar. 23-3; util. at Geneva, map, *The Eng.* June 1-3.

" SEDIMENT carrying, treatment of, Specht, *Eng. News*, Nov. 7-5; Seine, Paris, Harcourt, July 3, 31-6; do. *The Eng.* Mar. 12-6; imps. *Sci. Am. Sup.* Sep. 10-7; purification, Durand-Claye rep. *San. Eng.* Mar. 18-6; *Eng.* Feb. 19-6, stream gauging for Phil. water supply, Sanborn, *San. Eng.* June 3-6; Thames, crossing below London bridge, *Eng.* Feb. 16-3; purification, Aug. 21-5; movement of water in, Unwin, *The Eng.* Jan. 26-3; Tiber, regulation of, Montariari, *Van Nost.* Dec.-3; tidal, imp., Gould, *Van Nost.* Sep.-4; do. Delaware, Haupt, *Fran. Inst.* Oct.-7; and upland waters, value of maintaining, Browne, *Van Nost.* Sep, Oct.-5; Humber, May-5; *Eng.* Dec. 12; Unchagah, Can. Aug. 29, Sep. 5, 12, Oct. 24-4; vel. gauging in floods, Ritter, *Eng. News*, Aug. 6-7.

RIVERS, measurement of, *Am. Eng.* June 6-20-**4**; water level indic., Ravaglia's hydrometrograph, *Elec. World*, Aug. 15-**5**; do. *Sci. Am. Sup.* Oct. 3-**5**; Wear, barges, iron hopper, *Eng.* Mar. 30-**3**; Weaver, nav. Sep. 12-**4**; do. Dutton sluices, *Sci. Am. Sup.* Jan. 24-**5**.

RIVETING, Holbrook, *Sci. Am. Sup.* Feb. 16-**4**; expts., French, *Ry. Gaz.* Feb. 11-**7**; machine, MacColl's, *Eng.* May 18-**3**; Nobert's, *Sci. Am. Sup.* Dec. 12-**5**; do. hydr., Bement, *Ry. Gaz.* Mar. 4-**7**; do. plant, Berry, eng. *The Eng.* Feb. 20-**5**; do. Delaloe, inv. *Sci. Am. Sup.* May 21-**7**; do. ship, *The Eng.* Nov. 30-**3**; do Stephens, *Eng.* June 3-**7**; do. Tweddell's 150-ton, *Iron Age*, Sep. 10-**5**; do. *Mech.* Sep.-**5**; do. *The Eng.* July 31, Aug. 7-**5**; do. *Eng.* May 4; do. machinery, Nov. 30-**3**; do. May 1-**5**.

RIVET MAKING, Plymouth, Mass. *Iron Age*, June 3-**6**.

RIVETTED JOINTS, expts., Kennedy, *The Eng.* May 15-**5**.

RIVETTER, plate closing, *The Eng.* July 1-**7**.

ROACH, JOHN, *Mech.* Feb.-**7**; n. *Ry. Gaz.* Jan. 14-**7**; *The Eng.* Jan. 21-**7**.

ROAD, harrow for macadamized roads, *Sci. Am. Sup*, Apr. 21-**3**; locomotion, centenary of, Macfie, Feb. 16-**4**; locomotive (traction eng.), and roller, *Am. Eng.* Dec. 26-**4**; Foden's, *The Eng.* July 20; Fowler's, July 20-**3**; 16 H. P. stm. plowing, *Sci. Am. Sup.* Jan. 20-**3**; high speed, McLaren, *The Eng.* June 1-**3**; do. Dec. 16-**7**; for heavy haulage, do. Dec. 12-**4**; Eddington, Jan. 21-**7**; Stockport trials, Sep. 19-**4**; and rail truck, Perrett's, Oct. 22-**6**; rail and wheel, *Sci. Am. Sup.* Mar. 24-**3**; roller, stm., and traction eng. *Am Eng.* Dec. 26-**4**.

ROADS, Sears, *Am. Eng.* Feb. 15-**4**; govt., in Italy, *Eng. News*, Apr. 24-**6**; macadam, construct., J. W. Brown, *Sci. Am. Sup.* Nov. 13-**6**; roadways of New Mexico, Pullen, *Soc. Arts*, Mar. 11-**6**; repair and maintenance of, Wheeler *San. Eng.* June 25, July 9-**7**; in Spain, *Eng. News*, Apr. 3-**6**; in Switz. *The Eng.* Apr. 6, 6, May 4-**3**.

ROBERTS, MILTON J., por. *Sci. Am. Sup.* Aug. 27-**7**.

ROEBLING, JOHN A., por. *Eng. News*, May 26-**3**; do. *Sci. Am. Sup.* July 14-**3**.

ROGERS, WM. B., por. *Soc. Arts*, Oct. 12-**2**.

ROLLING MILL, frictional, reversing clutch, Weston's, *The Eng.* Jan. 19; eng., Seraing, July 27-**3**.

ROLLING MILL, eng., comp. reversing, at Codnor Park, Walker, eng. *The Eng.* May 30; do. Tannett, eng. June 6, 13-**4**; Stevenson's, Aug. 13-**6**; at Newport mills, Head, May 6-**7**; sheet, Codnor Park, June 20-**4**; for covering sheets, Daelin's, July 22-**7**.

ROLLS, gradual reduction, for hard subs., Hall's, *The Eng.* Mar. 12-**6**.

ROOFING MACH., edging and seaming. Brandriff, *Iron Age*, Apr. 21-**7**.

ROPE driving, *Iron Age*, Aug. 19-**6**; white manilla, strength of, *Mech.* Aug. 18-**3**; wire, towage on Rhine, *Eng.* July 13-**3**.

ROPES, painted and tarred, ap. *The Eng.* Apr. 22-**7**.

ROTARY ENGINES, Bliss, *Iron Age*, Aug. 14-**4**; Dec. 31-**5**; Jan. 28; parallel shaft do. Feb. 25; Mar. 4-**6**; Washburn, Aug. 11-**7**; Waldron, *Mech.* Sep.-**4**; for locoms., Goodwin, Sep.-**5**; Wade's, *Am. Eng.* May 9-**4**; high-speed, Rigg, Sep. 28-**7**; Harrington's, *Elec. Rev.* Jan. 3-**5**; do. *Elec. World*, Jan. 3-**5**; do. *Sci. Am. Sup.* Jan. 3-**5**; Pinchbeck's, Aug. 11-**3**; do. Oct. 4-**4**; do. *Eng.* Jan. 1-**6**; do. *The Eng.* June 8-**3**; Feb. 6, 13-**6**; Kingdon's, *Eng.* Dec. 3-**6**; do. *The Eng.* Aug. 6-**6**; and pump, Goldschmidt, July 6-**3**; Oct. 16, 23; inclined shaft, Dec. 18; with movable partition, Dec. 25-**5**; parallel shaft, Parson's, Jan. 15, Feb. 5; n. Apr. 16-**6**.

RUBBER, india, prices, *Iron Age*, Jan. 16-**7**; tubing mach., Royle, *Mech.* Oct.-**5**; substitute, vulcanized fibre, Apr.-**5**; do. Balata as a, *Van Nost.* Sep.-**5**; elastic fabrics manuf. imps. *Sci. Am. Sup.* June 23-**3**; wks., Silvertown, elec. lighting, *Eng.* June 11, 18, 25-**6**.

RUBIES, artificial, *Fran. Inst.* Nov.-**6**.

RUSSIA, drainage, Pinsk marshes, *Eng. News*, Dec. 26-**5**; iron, metal and coal industries, *Iron Age*, Apr. 29-**6**; U. S. trade with, Apr. 2-**5**; mechan. industries of, *The Eng.* Feb. 23-**3**.

SABLE ISLAND, submergence, *Sci. Am. Sup.* May 10-**4**.

SAFE DEPOSIT VAULT, *San Eng.* Sep. 23-**6**; banker's strong room, Chatwood Safe & Lock Co. *Eng.* Dec. 2-**7**.

SALT, manuf. *Iron Age*, Feb. 24-**7**; wks., Clarence, Middlesbrough, *Eng.* Oct. 12-**3**; mines, Northwich, Sep. 26-**4**.

SAND blast file sharpener, Tilghmans, *Iron Age*, Feb. 7-**4**; *Sci. Am. Sup.* Dec. 22-**3**; *Eng.* June 1-**3**; *The Eng.* Nov. 9-**3**; Matthewson's ap. June 12-**5**.

" MOLDING MACH., Rice, *Iron Age*, Aug. 5-**6**.

SAN FRANCISCO, st. Ry. stat. *Eng. News*, Mar. 6-**6**.

SANITARY ENG. See also BUILDINGS; HEALTH; PLUMBING; SEWERAGE.

" EUROPEAN cities, condition of, *Eng. News*, June 23; h. drains, cast iron, Aug. 11-**3**; do. drainage, Gerhard, Jan. 26; do. Durham sys. Feb. 2-**4**; town ordinances, Sep. 26; Coney Is., Gerhard, Oct. 3-**5**; condition of soil under cities, Apr. 9; h. drains and traps, Honeyman, Oct. 29-**7**.

" ENG. patents, mortality reps., tables, *San. Eng.* files; arrangements in Vanderbilt's res. *San. Eng.* Jan. 4; McClosky trap ventil. patent suit, Jan. 18; sewer connections to h's, May 10; water closets, May 10, 31; h. drainage, Aug. 2, 23; arsenical poisoning by wall papers, Stevenson, Aug. 9–30, Sep. 6, 13; pub. bath, Berlin exhib. Oct. 11; baths, Turco-Russian, N. Y. Oct. 18-**3**.

" SEWER connections and water supply of dwellings, *San. Eng.* Feb. 14; Pullman from a slate medicine point of view, De Wolf, Apr. 17; healthy foundations, G. Brown, June 12, July 17, 31, Aug. 14, Sep. 4; pub. baths and wash houses, St. Pancras, London, Oct. 23; eng. as it now is, Rawlinson, Oct. 23; H. H. Cook's res., plan, Nov. 13-**4**; round hos. wards. Snell, Nov. 19-**5**; stat., Italy, Apr. 22; hos., for Bournemouth commissioners, Aug. 19; destruction and preserv. of life, Chadwick, Sep. 2; and domestic eng. during Montreal small pox epidemic, Nov. 6-**6**; condition of the dwelling h. Jan. 1-**7**.

" ARCHITECTURE, *Am. Eng.* July 23-**5**; drainage under dwellings, Clarkson, *The Builder*; do. *Van Nost.* Feb.-**5**; science, advances in, Oct.-**6**; do. *Nature*; h. appliances, Botting, *Sci. Am. Sup.* Jan. 27; atmos., disinfection of, Lee, Dec. 29-**3**; sewer gas and its dangers, McCaskey, Jan. 5; h. drainage and refuse, Galton, Jan. 26; h. sewage disposal, A. W. Bell, Feb. 23; do. M. T. Clark, Dec. 27-**4**; prog. Aug. 7-**6**; relations of temp. to health in h's, Benjamin, Mar. 19; disinfectors, Thursfield, Sep. 17-**7**; sanitation, T. Wins, Jan. 17-**5**; do. 50 years of, Jan. 1; do. of towns, Gordon, Nov. 19-**7**; legislation, petrol. products as related to, Peckham, *Soc. Arts*, Apr. 23-**5**; h's, *Eng.* Aug. 22-**4**; survey, England, *The Eng.* Oct. 15-**6**.

" INSTITUTE of Grt. Britain, pro. *San. Eng.* Oct. 25, Nov. 1-**3**; Aug. 6, Oct. 22-**5**; Dec. 25-**6**.

SAW-MILL, hist. *Iron Age*, Feb. 24-**7**; head blocks, Parish, *Am. Eng.* Sep. 14-**7**.

SAWS, cross-cut, *Iron Age*, Jan. 25-**3**; manuf. Nov. 5-**5**; circular and band, Ransome, *Eng.* May 13-**7**.

SCHEELE, CARL WILHELM, B. F. Hays, *Sci. Am. Sup.* Feb. 21-**5**; por. Oct. 30-**6**.

SCHOOL, tech., Mass. Inst. of Technology, hist. (Wm. B. Rogers), *Soc. Arts*, Oct. 12-**2**.

SCIENCE, walking, odometer (pedometer), *Eng. News*, July 25; do. steps, length of, July 25; hardening plaster, Mallion, Paris, Aug. 8-**5**; and indus., relations, *Iron Age*, Oct. 8-**5**; mission of, Thurston, *Am. Eng.* Sep. 19, 26, Oct. 3–17-**4**; 6 gateways of knowledge (senses), *Van Nost.* June; do. W. Thomson, *Sci. Am. Sup.* Dec. 1-**3**; do. May 17-**4**; Thurston, addr. *Van Nost.* Oct; mechan. prog., Bramwell, addr. Nov.-**4**; physical basis of phenomena, Bates, Oct.-**5**; Am. Assoc. pro. *Ry & Eng.* Sep.-**7**; in relation to the arts, *Fran. Inst.* Jan.-Mar; a plea for pure, Oct; and industry, prog., '82, Feb.-**3**; do. do. '83, Feb.-**4**; plant anal. as an applied, Abbott, July; do. chem. basis, Sep; notes, Feb, Mar, May, &c.-**7** and files; modern, scholastic prelude to, *Elec. Rev.* Aug. 23-**3**.

" MATTER, nature and existence of, Knowles, *Sci. Am. Sup.* Jan. 12-**4**; and eng., Westmacott, Dec. 29-**3**; dust-free spaces, Lodge, June 28; Soc. for Psychical Research, reps. Aug. 30; the infinitely great and infinitely little, R. A. Proctor, Nov. 15-**4**.

" ORIGIN and hist. of least and lowest living things, Dallinger, *Sci. Am. Sup.* Jan. 3; spectra of metallic vapors, Becquerel, Jan. 31; painless extinction of life in lower animals, B. W. Richardson, Feb. 14; spectroscopic exam. of vapors evolved on heating iron, etc., Parry, Feb. 28; protoplasm, Mar. 28; results of Lady Franklin Bay (arctic) exped. May 16; ether, properties of, G. F. Fitzgerald, May 30; trochoided plane, Hargrave, May 23; Nat. Acad. pro. May 23; causes of sex, Schlechter, June 20-**5**.

" AGENCY of water in volcanic eruptions, Prestwich, *Sci. Am. Sup.* July 4; sunlight and earth's atmos., Langley, July 4; forms of vibrating bodies, Decharme, July 18; eroding power of ice, Newberry, July 25; measurement of blood corpuscles, Ewell, Oct, 3, Nov. 7-**5**.

SCIENCE, motor centers of brain and mechanism of will, Horsley, *Sci. Am. Sup.* Oct. 17; cultivation of microbes, Oct. 17; Ramie (China grass), F. Watson, Oct. 24; do. as a textile material, Mason, Nov. 21; anæsthetics, synopsis of, B. W. Richardson, Nov. 14, 21; standard pulse reading, do. Nov. 14; bacteriology, Loomis, Nov. 21; climatic influence of forests, Chanceral, Dec. 12-5; Huxley, addr., Royal Soc. Feb. 6-6.

" NATURAL, Tabasheer, relation to mineral substances, Dyer, *Sci. Am. Sup.* May 28-7; physical, Inv's exhib. *Eng.* Oct. 23-5; growth and death, researches on, C. S. Minot, *Soc. Arts*, Jan. 10-4; the sea-serpent, Putnam, *Locom.* Oct.-6; do. Oct.-7; Am. Assoc. for Advancement of, pro. *Eng.* Oct. 15-6; do. Oct. 21-7; mechan. prog., Bramwell, *The Eng.* Sep. 5-4.

SCREWS, perfect, prob. solution, Rogers, *Am. Eng.* July 4-18-4; wood, standard sizes, *Mech.* Apr. 19; perfect, Rogers, May 31, June 7, 14-4; machs., Jones, May 5; cutting-lathe, Prov. *Am. Eng.* June 26-5; forging mach, Apr. 15-6; do. Fairbairn's, *Sci. Am. Sup.* Sep. 11-6; do, do. *The Eng.* Mar. 19-6; manuf. in R. I. *Iron Age*, July 9, 30-5; perfect, solution of prob. June 5, 12, July 3-4; wood, Harvey rolled, Sep. 3-5; screw cutting, see LATHE, screw cutting.

SCREW THREADS, *Iron Age*, Oct. 7-6; standard, *Mech.* Jan. 13; in cast iron, Barnes, Sep. 22; gauges, Oct. 20; fine, standard (watch and math. instrums.), English, Oct. 27-3; Jan. 12; absurdities, Jan. 12-4; Mas. Car. B. Club, *Ry. Gaz.* Jan. 5; standard, July 20-3; Sep. 24-6; Seller's sys. Aug. 19-7; do. or Fran. Inst. sys. *Fran. Inst.* Apr.-7; do. table, *Sci. Am. Sup.* June 28-4; Whitworth, etc. *Eng.* Sep. 10-6.

SCUTCHING MACH. *Sci. Am. Sup.* Oct. 8-7.

SEAWEED, econom. applics. of, E. C. Stanwood, *Sci. Am. Sup.* July 12-4.

SEWERS AND SEWERAGE, tank, Boston, *Eng. News*, Feb. 10; pumping station do. Feb. 17; sys., Norfolk, Va., Lamb, May 5; of Nahant, Mass., Bowditch, Dec. 8; sys., Kansas C. Dec. 15-3; sys., Boston, Jan. 5, 5, 26; do. City Eng. rep. May 10; Kansas C., Chanute, Feb. 16, Apr. 26, May 3, 10, Pearson, May 24; combined vs. Waring sys., Moore, May 17; do. and separate, McMath, May 24; storm overflow, Deptford, Lond. June 21-4.

SEWERS AND SEWERAGE, and drainage, Mexico, *Eng. News*, July 5; flushing tanks, Rome, July 12; Wandle-Valley main drainage, Crump, Oct. 11, 18; sewering of towns on separate sys., A. E. White, Nov. 15-4.

" STANDARD form, Washington, *Eng. News*, Jan. 17; sewerage, do. Feb. 21; purification at Frankfort, Gerhard, Feb. 21; wks., Leeds, Mar. 7; London Met. rep. Mar. 28, Apr. 18; Apr. 11; wks., Buxton, Thush sys. May 2; outfall wks., Burham, Brady, June 6; disposal, Paris, June 20; A B C proc., Aylesbury, England, July 25; Nichols, Aug. 15; prices, Baltimore, Nov. 14-5.

" VENTILATION, *Eng. News*, Jan. 30; Boston, Feb. 27, Mar. 6, 27; ventilator, Eachus, Mar. 6; and garbage removal, European, Mar. 27; London, expts. with, Apr. 10; bu., Brooklyn, May 1; Providence, May 8, 22, intercepting, Sep. 11; spec., Shreveport, June 19; Washington, Oct. 2, 9; of Paris, Nov. 6; lower Thames valley, Mellis, Dec. 18-6; disposal, Providence, R. I., rep. Jan. 1; Phil. Jan. 1; assessments, Fall River, Mass. Jan. 8; proposals, May 28; foundations, contract prices, June 4; distrib. water, quantity, Arnould, Sep. 3; Englewood, N. J., prices, bids, Sep. 17; treatment, expts., Birch, Sep. 17-7.

" WORKS, Boston main drainage, *Mech.* Dec.-5; Providence, rep., Gray, *Am. Eng.* Apr. 10; separate vs. combined sys., B. Wins, Apr. 24, May 1; separate sys., Pierson, Aug. 13-5; ventil., Eachus, Apr. 8-6; Shone hydro-pneu. sys. June 22-7; separate sys., Baumeister, *San. Eng.* May 3, 24; disposal by subsurface irrigation, Philbrick, May 17; ancient, and water supply, Silesia, Doerich, Oct. 4-3; Bost. main drain. wks., hist., map, Feb. 28, Mar. 13, 27, Apr. 3; sys., Memphis, cost of, Mar. 20, 27; of Waterbury, Conn. June 19; à large, Lond. July 24; disposal, H. Robinson, Nov. 27-4.

" COMPOSITION of, Nichols, table, *San. Eng.* Sep. 3; refuse destructor at Bombay, Dec. 31-5; scheme for valleys of Mystic and Blackstone r's, rep. Feb. 11; disposal, methods of, Bost. Commission, Feb. 18, 25; sys., Schenectady, N. Y. Apr. 22; precipitation wks., Sheffield, England, July 1; ventil., Strachan, Aug. 12; disposal at Providence, Sep. 23; farm at Saltley, England, W. S. Till, Oct. 7, 23; ap. for flushing, Sep. 23-6.

SEWERS AND SEWERAGE, treatment at London, *San. Eng.* Oct. 23; construct and sewage disposal, Philbrick, Dec. 4-**6**; do. Jan. 1, Mar. 5, June 18, Aug. 6-**7**.

" SEWAGE disposal at Mass. Reformatory, Concord, and sludge pumps at Walthamstow, Essex, *San. Eng.* Jan. 8; of Providence, rep. Jan. 8; of Lakewood, N. J. Jan. 22; sys. and tunnel at Bar Harbor, Feb. 12; Carson's trench mach. Feb. 19; construct. Mar. 19; H. of Parliament, Westminster, Apr. 2–16, May 7, 14; and aqueducts of ancient Rome, Lanciani, Apr. 2; removal of shallow flowage from Boston storage reservoir, Apr. 16; Newark sys. May 7, 14; receiving and catch basins, Waterbury, Conn. July 9; construct., Hetherington, Ang. 20, Sep. 3, 10-**7**.

" REFUSE disposal of towns, Virchow, *Van Nost.* Aug; size and ventil., White, Dec.-**4**; London, rep., Galton, Apr; depositing tanks, Frankfort, Lindley, May; purification, factory, Rockner proc. June; town drainage, Russia, state of, Abramson, June; purification, Thresh, July, Oct.-**5**; do. *The Builder*; ventil. of, Eachus, *Van Nost.* Mar; Mass. Commiss. rep. May; chem. treatment, London, June; irrigation wks., Berlin, Miller, July; treatment, Tidy, July; ventil., Strachan, Nov.-**6**.

" SEWAGE, *Fran. Inst.* Aug.-**5**; town, mechan. appliances in. Apr.-**6**; gas, cremation of, Thomas, Jan.-**7**; pipe, manholes on, *Sci. Am. Sup.* Jan. 12; disposal, H. Robinson, Dec. 13-**4**; plan for Providence, Gray, May 30-**5**; wks., Boston, Jan. 16; removal, H. White, Feb. 6; ventil., Eachus, Feb. 20; and micro-biology, Faraday, Mar. 13; flushing ap., Parenty's, Mar. 27; disposal, pneu., Duckham's sys. May 22; do. in Berlin, Sep. 18-**6**; filter press, Drake-Muirhead, July 2; wks., Hendon, July 16-**7**.

" PUMPING eng., Pullman, Ill. *Eng.* Apr. 6-**3**; proc. Apr. 30; ventil., Eachus, Sep. 17; wks., Bolton, Oct. 29-**6**; sludge, Dibdin, Crump, Feb. 4; and refuse dumping barge, Baney, May 27; imp. sys., Boston, results on death rate, Aug. 5; do. effect on health, Aug. 5-**7**; pumping engs., h. and pumps, Whitwood, *The Eng.* Mar. 9, 16; and streets, London, table, Mar. 16; wks., Brownhills, May 18; wks., Salford, lime mixing mach. July 6, 13, Aug. 10, 10-**3**; storm overflow, Deptford, June 6; sewage, Shone sys. June 27-**4**.

SEWERS AND SEWERAGE, wks., Abergavenny, *The Eng.* Feb. 6, 13; pumping, Winchester, cost of, Mar. 13; A B C proc. at Aylesburg, June 26; Lower Thames Valley, H. Robinson, July 10; pumps, Shone's hydro-pneu., Henley wks. Aug. 21; Lond. drainage, J. O. Phillips, Dec. 11-5; wks., Stratford-on-Avon, E. Pritchard, eng. Jan. 1, 15; ventilator, Eachus, Jan. 15; Clapham, &c. Mar. 12, Apr. 2; and aqued. at Wandsworth, Mar. 19; London, chem. treatment of, Apr. 16; pumps, Walthamstow, June 18; and water wks., Petersfield, H. Robinson, eng. Oct. 8, 15; sewage London, Nov. 12; wks. at Southampton, Nov. 19-6.

" SEWAGE, London, cost of treating, *The Eng.* Jan. 14; do. disposal, Apr. 15; do. precipitation wks. at Barking, Feb. 4, 11; sludge and disposal, Dibdin, Feb. 25; do. Crump, Feb. 25; wks., Hendon, May 6; treatment, expts., Dibdin's, Birch, Aug. 5; util. wks., Leicester, Aug. 12; wks., Acton, Sep. 16; of Henley on Thames, Oct. 21-7.

SERAING WORKS, Societe Cockerill, Bel. *Iron Age*, Sep. 13-3.

SEWING MACH. motor, Heinrici's, *Sci. Am. Sup.* May 30-5; mach., Urquhart, June 18-7; Singer wks. at Kilbowie, *Eng.* Aug. 28, Sep. 4-5.

SHAFTING, compressed steel, tests, Watertown, *Iron Age*, June 7; transmiss. of power by, Dec. 13-3; clutch, heavy, 1,000-H. P., Weston, Oct. 2-4; couplings, interchangeable, Nov. 11-6; friction clutch, J. Smith Woolen Co. Apr. 28; do. Moore, May 19; Stow flexible, May 5-7; clutch, Horton, *Mech.* Mar. 17; do. Wilkinson, May 5; do. Realeaux, June 9; do. Vielhaber, Nov. 24; compressed steel, Naylor, May 19; levelling instrum., Macdonald, Aug. 25; sys., Yale & Towne Co. Sep. 22, 29; mill, notes, Dec. 1-3; do. Jan. 26; coupling, Gallois, Mar. 1; load of, May 3; speed indic., Woodbury, May 3; do. O. Smith, June 21; do. Young, July; Flecming nest gear, Aug; clutch, 1,000-H. P., Weston, Sep.-4; speed indic. gauge, Hedge, Aug; frictional resist. of, Webber, Dec-5; deflection, Grimshaw, Aug.-7.

" FRICTION CLUTCH, *Am. Eng.* Oct. 10; H. P. of, Carr, Nov. 28-4; frictional resist. of, S. Webber, Dec. 3-5; Apr. 29; turned, price lists, inaccuracies, tables, July 28, Aug. 4, 18, 25-6; price lists, standard, table, Mar. 30; fr. clutch, Macdonald, Aug. 10-7; do. Dohmen-Leblanc, *Sci. Am. Sup.* Sep.27-4; speeding up, Hobart, Oct.22-7; mill, *Locom.* Oct.-3.

SHAFTING, strength of, *Eng.* Apr. 20-3; coupling, friction, Hermanni, Sep. 12-4; fr. clutch, Bagshaw, May 15-5; rev. counter, Kaiser, Feb. 19; fr. clutch, Mather, July 30; do. Fisher, Aug. 20-6; strength, Greenhill, *The Eng.* Apr. 20-3; bearings, friction of lubricated, expts., Tower, Mar. 7, 21; coupling, elastic, Brotherhood's, Apr. 4; friction of lub. journals, W. R. Browne, July 25-4; coupling, Jameson's, and Frisbie's fr. clutch, Jan. 9; do. Fisher's, July 31; and bearings, Oct. 16; coupling, flexible, Hall's, Nov. 6-5; steel, tests, Mar. 11-7.

SHAPING MACH., Prentiss', *Iron Age*, Mar. 13-4; do. *Mech.* Feb. 23, Apr.-4; rotary, Krentzberger's, *Sci. Am. Sup.* Oct. 6-3.

SHEARS, power, Bliss, *Iron Age*, Mar. 4-6; shearing mach., 1,000-ton hydr. *Eng.* Dec. 23-7.

SHOP COUNCIL, *Iron Age*, Aug. 19-6.

SHOVEL, solid steel, *Iron Age*, Nov. 18-6.

SIBLEY COLLEGE, Cornell Univ. *Am. Eng.* Nov. 5, 19-5.

SIBLEY, HIRAM, por. *Sci. Am. Sup.* Feb. 27-6.

SIEMENS, CHARLES WM. *Eng. News*, Nov. 24-3; *Eng.* Nov. 23-3; *The Eng.* Nov. 23, 30, Dec. 14, 28-3.

SILLIMAN, BENJ. *Sci. Am. Sup.* Mar. 28-5.

SILK, mach., Atherton, *Sci. Am. Sup.* Jan. 13-3; producing bombyces, rearing of, Wailly, May 10-4; mechan. reeling of, Nov. 19-7; reeling mach., Sewell's, *The Eng.* Aug. 5-7.

SLATES, Rutland and Wash. City, tests, Williams, *Van Nost.* Aug.-4.

SLOTTING MACH., understroke, *Iron Age*, Aug. 14-4; Newton, *Mech.* Aug.-4; portable, and keyway cutting, Spencer, eng. *The Eng.* Feb. 27-5.

SMITH, CHAS. A. *Am. Eng.* Jan. 9-5.

SNOW, removal by salt, Paris, *Eng. News*, Feb. 6, Dec. 11-6; and salt in N. Y. Jan. 8; removal in Paris, n. Mar. 12-7.

SOAP, toilet manuf. and mach., Beyer's, *Sci. Am. Sup.* Nov. 15-4; making, laund. and toilet, June 20-5; toilet manuf., C. R. Wright, Jan. 23, 30, Feb. 6; manuf. July 10-6; making, Watt, *Eng.* Feb. 29-4; do. *The Eng.* May 28-6.

SOCIETY OF ARTS, Mass. Inst. of Tech., list membs., '85, *Soc. Arts*-6; do. '86,-7; pro. '82-3—'86-7.

SOCIETIES, Boiler makers and iron ship builders, rep. *Eng.* Apr. 25-4. See also ENGINEERS, CIVIL, INST., MECHAN; MINING ENGINEERS.

SOUND, mills, S. P. Thompson, *Mech.* Mar. 29, Apr.-4; do. do. *Sci. Am. Sup.* June 21-4; theory of, Mott, Apr. 3-6; wave theory, do. May 28; sense of hearing, Rutherford, Nov. 5-7.

SOUTH AMERICA, U. S. trade with, *Iron Age*, Jan. 13-7.

SPACE, physical, *Van Nost.* July; geometry of, Randolph, Aug.-3.

SPAIN, U. S. trade with, *Iron Age*, Dec. 3-5; pop. n. *Am. Eng.* Dec. 29-6.

SPECTROSCOPE and weather, *Fran. Inst.* Jan.-3.

SPEED INDICATORS, *Iron Age*, June 26; Young's, July 24-4; Hedge's, Aug. 13-5; Pratt, *Elec. Rev.* Apr. 24; recorder tachometers, Oct. 23-6; Young's, *Elec. World*, Sep. 13-4; Hedge's, Apr. 17-6; Braun's, *Sci. Am. Sup.* Aug. 2; counter, Deschien's & Young's tachometer, Nov. 1-4; elec., Farquharson & Lane's, Jan. 17-5; do. tachometer, Jan. 15-7; do. Horn's, *Eng.* Dec. 3-6; counter, *The Eng.* Nov. 2-3; gauge, Hedge's, June 26-5; Blythswood, Nov. 20-5; Willis' hydropneu. speedometer, Oct. 28-7.

SPHERE and roller mach., Shaw, *Iron Age*, Dec. 24-5.

SPHINX, *Eng. News*, May 1-6.

SPINNING, philosophy of twist, *Wades Fibre & Fab*; do. *Sci. Am. Sup.* May 23; 100-spind. mule, Jan. 24; aut. yarn spinner, Lawson's, Aug. 22; cop winding mach. Nov. 7-5; ring throstles, Bourcart, July 24; motions in bobbin frames, Nov. 13-6.

SPRINGS, spiral, Hand, *Mech.* Sep.-7; helical, Cloud, *Am. Eng.* May 23-4.

SPRINKLERS, aut., for protect. against fires, Woodbury, *Soc. Arts*, May 21-5. See also FIRE PROTECTION.

ST. LOUIS industries, *Iron Age*, Aug. 23-3.

" PAUL and Minneapolis, *Iron Age*, May 29-4.

" PETERS, Rome, hooping of dome, *Iron Age*, Aug. 27-5.

STAMP MACH., Stamp End wks., Lincoln, *Eng.* Jnly 31-5.

STABLE COMMODITIES, fall in prices since '75, *Iron Age*, Mar. 19-5.

STARCH, manuf. steam plant, France, *Sci. Am. Sup.* Oct. 20; Salomon, Nov. 24; potato, Angele's ap. Dec. 15-3.

STATISTICS, foreign, *Eng.* Sep. 11-5.

STATUE OF LIBERTY, BARTHOLDI; N. Y. harbor, *Eng. News*, Aug. 25-3; Jan. 5-4; Apr. 11, 18, cost, Aug. 15-5; Nov. 20-6; *Iron Age*, Aug. 14-4.

STATUE OF LIBERTY, construct. *Iron Age*, June 11; pedestal, June 18-**5**; Aug. 12-**6**; *Mech.* June 28-**4**; *San. Eng.* Oct. 23-**6**; *Elec. World*, May 30-**5**; Goodridge plan for erection, *Sci. Am.* May 26-**3**; *Sci. Am. Sup.* May 10-**4**; manuf. Sep. 12-**5**; Oct. 23-**6**; dimens. *Locom.* Nov.-**6**; *Eng.* Dec. 10-**6**.

" DUKE OF WELLINGTON, at Aldershot, erection of, *Sci. Am. Sup.* Sep. 19-**5**; Germania, at Bingen, German Nat. monument, Oct. 13, Nov. 24; do. War and Peace, Dec. 15-**3**; do. Siemering, Sep. 25-**6**; statues, great bronze, *Iron Age*, Oct. 1-**5**.

STEAM, generation of, *Iron Age*, Jan. 31; users, estimates for, June 26; distrib. in cities, N. Y. Aug. 7-**4**; Co. N. Y., bu.'s July 9-**5**; substitutes for, July 1; power of Prussia, Sep. 23-**6**; pressures, high, use of, June 2; gen. Sep. 29-**7**; superheated, Porter, *Mech.* Feb. 3; for power and heating, econ. of combined use for, June 9; flow of in pipes, Rudiger, June 9, 30-**3**; gen. of, Jan. 26; users estimates, Emery, June 21, 28, July; distrib. in cities, N. Y. sys. Aug.-**4**; superheated, Mar.-**5**; do. Mar.-**6**; use of. Mar; evap. pans, exhaust, Stearns, sup. June; and power, cost of, Towne, sup. June.-**7**; centenary of (Oliver Evans), *San. Eng.* Sep. 17-**7**.

" ESTIMATES, Emery, *Am. Eng.* May 30, June 20, 27; energy of, Denton, Nov. 7-**4**; pressures, high, Feb. 9-**7**; econ. at Nat. Rubber Co. wks., Bristol, R. I., Hill, *Van Nost.* Feb.-**4**; making coal for tests, do. Dec.-**5**; expan. of, limitations, Marks, *Ry. & Eng.* Apr.-**7**; high-press., econ. of, *Fran. Inst.* May-**5**; econ. with compressed air, Strange sys. June-**6**; econ. by expan., Marks, Mar.-**7**.

" POWER of world, n. *Ry. Gaz.* Sep. 23-**7**; gen., W. Anderson, *Sci. Am. Sup.* Jan. 19, June, 14, 21; power, cost of, table, Emery, Mar. 22; distrib. in cities, W. P. Shinn, Aug. 9.**4**; effic. of, measuring, Mar. 14-**5**. transmiss., Emery, May 29; making by friction ap., Pearse, Sep. 11-**6**; sale of, Emery, Jan. 15; gen. of, Oct. 29; illus. (wood and sawdust b's.), Babcock, Dec. 17-**7**.

" VEL. of, Atkins, *Power & Trans.* Dec.-**7** &c; transmiss of, Emery, *Soc. Arts*, Feb. 25-**6**; properties of saturated, *Locom.* Apr.-**3**; dens. and vol. of air and saturated stm., D. K. Clarke, table, May-**5**.

STEAM, gen. and use, *Locom.* Aug.-**6**; do. Jan.-**7**; pressures, high, use of, Oct,-**6**; do. June; power and engs. of world, Aug.-**7**; distrib. in cities, *Eng.* Feb. 27-**5**; effic., measurement of, *The Eng.* Feb. 6-**5**; gen. of, Aug. 19, Sep. 9-**7**.

STEAM BOILERS, riveted joint tests, Moberly, *Eng. News*, May 26, June 2-**3**; Root wrt. iron sectional, Feb. 24-**4**; joint, Thom, Feb. 28-**5**; and eng., physical theory of, Wolff, Feb. 20, 27; fur. forced combust. Nov. 26-**7**; long cyl., dangers of, F. B. Allen, *Iron Age*, Apr. 19; flues, corrug., strength, Parker, May 3; Kent, May 24; welded, Oct. 4 &c.-**3**; construct. Mar. 6; and ship steel plates, water tube, Lucy fur., Pitts. June 12; construct. and strength, Sep. 11; corrosion and scale, Nov. 6; heads, bracing, Dec. 11; flues, resist. to collapse, Dec. 11-**4**.

" BOILERS, firing by Siemens gas sys. *Iron Age*, Feb. 26; Colby, Mar. 5; heating surface, value of position of, Aug. 6; plate rolling, Adamson sys. Nov. 19; material, Dec. 10; Arnold's, Dec. 24-**5**; power, Jan. 14; plate, soft steel for, Mar. 4; do. steel, failures in, Mar. 4; strength materials, rules, Apr. 1; do. Apr. 8; flue collapse, Apr. 8; safe working press. Apr. 8; firing tests, Sep. 23; Harrison, Dec. 2-**6**; and their settings, Hague, Jan. 18; case of low water in, Codman, Apr. 14; Lane, May 26; tubes, flow of gases thro. June 23; aut., Chic. Aut. B. Co. July 28; tubes, ribbed, Aug. 25; use of kerosene oil in, Lyne, Dec. 1; fur. smoke pre venter, Dec. 15-**7**.

" BOILERS, strength of, *Mech.* Jan. 20; fur. door and grate bars, Ashcroft, Feb. 3; long cyl., dangers of, Apr. 14; flues, corrug., strength of, May 12; testing by hot and cold water, Mas. Mech. discuss. Aug. 4; welded, Hartly, Aug. 18; do. Sep. 1-**3**; riveted joints, Jan. 5; grate bar, Rider, Jan. 26; fur. door, Miksch, Jan. 26; grates, dimens. Feb. 23; fur. combust., smokeless, Lawrence, Feb. 23; construct., forms of strength and effic., Strong, Mar. 1, Sep.-Nov; vertical, Pelestot, Apr. 5; and settings for blast furs., Witherow, Apr. 12; oil in, Apr. 19; inspection, Apr. 26; internally vs. exter. fired, Buel, May 10; forced draft for, Howden, May 17, 24; water tube, Lucy furs., Pitts., Kent, June 21; bracing, Aug; head bracing, Dec.-**4**.

" BOILERS, fur. anal. of chimney gases, *Mech.* Jan; strength and effic., tests, table, Strong, Jan.-**5**.

STEAM BOILERS, Colby, *Mech.* Feb; do. portable, and feed w. heater, Mar; vertical, Hazelton, Mar; and eng. fuel econ., Barnes, Apr; econ. by forced draft, screw propeller for, Brooklyn Navy Yard, Aug; grate and heating sur. Nov; fur., Stevens, Nov; tubular, Dec.-5; making, Ford, Jan.-July, Sep; Root, Apr.-6; vertical, Connery, May; heating sur. in tubes, rel. value, Fitch, May; use of kerosene oil in, Lyne, Dec.-7.

" BOILERS, controlled combust. *San. Eng.* Sep. 6-3; at Tribune bu., N.Y. Jan. 31-4; N. Y. Jan. 29; new form, Sep. 10-5; and eng., low press. Davy atmos. Apr. 22; grate bars, McDougall's self-acting, July 29-6; C. A. Smith, *Am. Eng.* Jan. 4-Apr. 18; Burnell, May 23; construct., etc., Burnell, July 25, Aug. 1; Firmenich, Aug. 29; Heine, Sep. 5; Colby's sectional, Sep. 26; tubes, sizes, table, Nov. 7; hor. tubular, construct., Scheffler, Nov. 14; H.P., standard, Nov. 21, 28; Lawson non-explosive, Oct. 24-4; do. Feb. 6, 27-5.

" BOILERS, fur., Blanchard, *Am. Eng.* Jan. 16; feeding at bottom, Mar. 20; plates, thick steel, W. Parker, May 15, 29; water tube, Babcock, June 19; and engs. in France, '83, number, July 3; light tubular, Cadiat, Dec. 3; feed w. and scale compounds, Dec. 17; rating by horse powers, C. B. Richards, Nov. 12, 19, Dec. 10-5; for h. heating, Gorton, Mar. 4; fur., Davison, Apr. 29; tube arr. May 13; feed water, Aug. 4, 11; Hipkin's, Aug. 18; management, Sep. 29, Oct. 6-27; settings, Hague, Nov. 24-6; grate bars, Mar. 23; aut., Chic. Aut. B. Co. Aug. 3; use of kerosene oil in, Lyne, Nov. 30-7.

" BOILERS, furnace, smoke prevention, England, *Ry. Gaz.* Aug. 15-4; safety ap., German, July 23-6; tubes, strength, *Van Nost.* Feb.-3; riveted joint tests, Moberly, Jan; corrosion and scale, King, June; defects, Engert, Sep; furs., combust. in under press., Howden, Sep; explosions, Kays, Nov.-4; riveted joint tests, Kennedy, July; plates, thick steel; Parker, Sep.-5; tubes, ribbed, Chomienne, France, *Ry. & Eng.* May-7; cast iron in, *Fran. Inst.* Mar.-May; tests by hydrostatic press. Aug; as magazines of explosive energy, Dec.-4; do. Jan; Zell, Safety St. Gen. Co. *Elec. Rev.* Jan 2; fur., Jarvis, Apr. 23-7; Harrison's (C. I. sectional), *Elec. World*, Feb. 27-6.

" BOILERS, safety and feed ap. *Sci. Am. Sup.* Mar. 10-3; furs., smoke burning, F. C. Smith, Jan. 19, Feb. 16-4.

STEAM BOILERS, tubes, keeping tight, *Sci. Am. Sup.* Apr. 5; incrustation prevention by zinc, Sumburnking, July 5; hor. tubular construct., Scheffler, Dec. 6; tubes, sizes, etc., table and rep. Dec. 13, 13-4.

" BOILERS, fur., blow pipe flame, Engert, *Sci. Am. Sup.* Jan. 17; do. Blanchard's, Feb. 28; do. Crompton's dust fuel, Aug. 8; Anderson, Aug. 22; fur., F. Siemens', Aug. 29; do. Perret's dust burning, Nov. 28-5; J. M. Allen, Mar. 20; combust. and fire-boxes, Coleman, Oct. 2; with gasogene furs., Albin, Dec. 11-6; for wet bagasse and nat. gas, and aut. stoker, Babcock, Dec. 24-7.

" BOILERS, inspection, ins., defects, etc. *Locom.* files, vertical, J. M. Allen, des. *Locom.* Jan, Mar; riveted joints, J. H. Cooper, Jan; long, dangers of, Feb; do. bracing, May; domestic, Mar; feed pipe connection, May, Aug.-3; do. Jan.-5; iron and steel expts., J. M. Allen, Feb, Apr, July, Dec; hand hole plate, Apr; cast iron in, Apr; anti-incrustation powders, Fairbairn, Apr; corrosion and scale in, July; sediment collecting in, cals., table, Dec; safety valve pipe, rule for, Dec.-4.

" BOILERS, construct., use of steel in, *Locom.* Feb; fur. forced draft, May, Sep; rivets and rivet heads proportions, June; riveted joints, Kennedy rep. June; stm. pipe connections, July; grate and heating surface, Sep; fire door linings, Nov.-5; scale, Jan; riveted joints proportions, Jan; defects, Apr, July; rivets, bess. steel for, June; domestic and drums, July; firemen, July; connections, dangerous, Aug.-6; grate bars, F. B. Allen, Jan; manhole for bleaching keirs, Jan; flues, flow of gases thro. Feb; setting, May; surface blow off ap. June; stm. and mud drum connections, July; fire surface limit, July; corrosion, examples, Aug; high press., construct. of, Oct; upright tub., heating sur. of, Oct.-7; safety, J. R. Robinson, *Soc. Arts*, Dec. 27-3.

" BOILERS multitub., Bellamys, *Eng.* Apr. 27; water-tube, Thornycroft's, May 18; flue, Engert's, Sep. 14-3; sectional, Hardingham, Jan. 11; forced draft, Apr. 11, 18; portable sectional, Sandycroft, Sep. 19; joint, Thom, Oct. 10-4; vertical, Coles, Apr. 3; and mechan. stoker, Knap, May 1; Babcock, Inv's exhib. May 1; riveted joints, rep., Kennedy, July 3, 10; Root, Sep. 25; Arnold, Nov. 27-5; Heine, Apr. 2; forced combust. Apr. 23, May 7, 21, 28-6.

STEAM BOILERS, radiation tests, Eng. lab. *Eng.* July 30; fur., Silvester's, Sep. 24-**6**; helical joints, notes, Jan. 21, Feb. 25, Mar. 4, 18, 25, Apr. 1-29, May 6, 13, 27, June 3, 10, July 1; flues, helically corrug. May 27; making plant hydr. May 27; fur. mechan. stoker, Proctor, Sep. 9; do. Sep. 23-**7**.

" BOILERS, furnace econ. *The Eng.* Jan. 19, n. Feb. 2; feed w. reg., Jochumsen's, Apr. 13; elephant, Apr. 27, July 13; Hodge's, July 13; Crossness pumping station (corrug. flue), July 27-**3**; bk. n. Feb. 29, Mar. 7; elephant, Livet's, May 9; Root & Stollworks feed w. purifier, July 18; effic. July 25; fur. smoke abatement, Aug. 15; fur., Engert's blow pipe flame, Dec. 19-**4**; do. do. n. Jan. 20-**5**.

" BOILER setting, hor. *The Eng.* Feb. 20; heating sur., influence of position, Mar. 13; furs., Boswell, Mar. 13; feed w. reg., Grossman, Mar. 20; effic. Mar. 20; fur. combust. under press. May 29; as magazines of explosive energy, Thurston, June 26, July 3; forced draft by revolving screw in chimney, Kafer, July 3; single riveted lap joints des., R. H. Smith, Aug. 21; semi-portable, Roundthwaite's, Sep. 18-**5**.

" BOILERS, water-tube, Babcock's, development of, illus. *The Eng.* Oct. 23; Hartley's vertical tubular, Nov. 13; hydr. tests, Mas. Mech. rep. Nov. 13; water-tube, Antwerp exhib. Dec. 4 and sup; Genetic, Dec. 25-**5**; flue and fur. tubes, Curtin's, Mar. 12; forced draught expts., Patterson, Apr. 16; fire boxes and combust., Coleman, Sep. 24; Cornish, Amsterdam water wks. Nov. 5-**6**; fur. feeder, Proctor's, Aug. 19; fur. stoker, Johnson's, Sep 23; and eng. wks., Patterson's, Naples, Dec. 30; fur. flues, strength of, Dec. 30-**7**.

" BOILER damper reg., Bowker, *Mech.* Apr.-**5**; *San. Eng.* Dec. 25-**6**; Kellam's, *Am. Eng.* Aug. 13-**5**; drilling machs., Campbell, *Mech.* Aug.-**4**.

" BOILER EXPLOSIONS, '85, *Iron Age*, Mar. 25-**6**; Riverdale testimony, *Mech.* Sep. 29-**3**; Bilston, England, Jan; and superheated water, Feb; in England, '84, Hiller, Oct.-**5**; causes of, Lowering, *Am. Eng.* Oct. 10, 24-**4**; in '84, table, Apr. 3-**5**; Jan. 14-**6**; Kays, *Sci. Am. Sup.* Sep. 27; causes of, Lowery, Nov. 15-**4**; Allen, Feb. 19-**7**; rep. inspectors Hartford St. B. Insp. & Ins. Co. *Locom.* Feb.-**3** and files; summary for year, Feb; (long) remarkable, July-**4**; U. S., '84, table, Feb; and superheated water, May; English, '84, July-**5**; rotary bleaching b. Oct.-**6**.

STEAM BOILERS, at nail wks. (*Iron Age*, July 18–'78), *Locom.* Nov.-**6**; summary,'86, table, Feb; in England,'86, Hiller rep. July; cracks, etc. Sep.-**7**; England, *Eng.* Feb. 16, Sep. 14; do. '82, Apr. 13-**3**; do. '83, Mar. 28-**4**; do. '84, Mar. 13, 20-**5**; do. '85, Mar. 26-**6**; do. '86, Apr. 29-**7**.

" BOILER, feed pump, donkey, Mumford's, *The Eng.* June 15-**3**; feeder, Sintz, *Am. Eng.* Oct. 31-**4**; do. *The Eng.* Feb. 20-**5**; feed water filter, Blessing, *Am. Eng.* Dec. 8-**6**; purifier and heater, Warner, Dec. 24-**5**; do. Hoppes live steam, July 6-**7**; filtering plant, Hyatt, *Iron Age*, May 12, June 16-**7**; feed water heaters, value of, *Eng. News*, Dec. 18-**6**; *Iron Age*, Aug. 20-**5**; Jan. 13; Reynold's, Nov. 24; Armstrong, Dec. 22-**7**; *Mech.* Mar.-**5**; Goubert, *Am. Eng.* July 3-**5**; Hooker, Feb. 18-**6**; "water tube," June 15-**7**; Berryman, *The Eng.* July 6-**3**; Compactum, Kirkaldy, eng. May 14; Burrell, July 16-**6**; Maclaine's, Sep. 30-**7**; fittings, *Mech.* Apr. 7-**3**; flanging mach., Basset, Aug.-**4**; gauge cock, water g. and stm. alarm column, Reliance Co. *Am. Eng.* Dec. 14-**7**.

" BOILER INJECTORS, Giffard, *Mech.* Apr. 14-**3**; "Standard," *Am. Eng.* Sep. 17-**5**; vs. steam pump effic., Henderson, Aug. 17, 31-**7**; principle of, *Ry. Gaz.* Aug, 6-**6**; Borland's, *The Eng.* May 8; ejector condenser, Morton's, Oct. 9; self starting, Gresham's, Nov. 13-**5**; exhaust, Dec. 9-**7**; do. *Am. Mach.*

" BOILER mechan. stokers, fur., Brightman, Zell Eng. Co. *Am. Eng.* Jan. 28-**6**; do. *Elec. Rev.* Jan. 30, Oct. 9-**6**; Sinclair's, *Sci. Am. Sup.* Mar. 10-**3**; Hodgkinson's, Oct. 4-**4**; aut., Babcock, Dec. 24-**7**; Knap, *Eng.* May 1-**6**; Hodgkinson's, *San. Eng.* Aug. 28-**4**; do. *The Eng.* Aug. 1, n. 22-**5**; safety valve, treacherous, Durfee, *Iron Age.* Aug. 6-**5**; do. do. *Mech.* Aug-**5**.; Barcon, *Ry. Gaz.* Sep. 30-**7**; Pinel, *Eng.* May 9-**4**.

" BOILER TESTS, (economic, etc.), inter. and exter. fired, *Iron Age*, May 1; for U. S. govt. May 22; rules, June 5; standard, Dec. 25-**4**; trials, standard, May 14; do. Fran. Inst. tests, July 23; vertical, Hazelton, *Mech.* Feb. 10; evap. power of bitum. coals, Kent, June 30; Harrison b. Aug. 11-**3**; rules, Kent, May 31, June 7; with Ill. coal, June 7; Dec.-**4**; effic. table, Strong, Jan; standard, Apr; do. rep. Am. Soc. M. E. May, June-**5**; do. do. *San. Eng.* June 4–25; warm blast ap. trials, rep., Hoadley, July 16-**5**.

STEAM BOILER TESTS, effic. for various conditions, Chart, J. A. Caldwell, *San. Eng.* Dec. 25-**6**; evap. power of coal, table, Feb. 19-**7**.

" BOILER TESTS, effic. table, *Am. Eng.* May 30; rules, Kent, May 23, Nov. 14-**4**; Barrus, Feb. 6; rules, Feb. 20; standard trials, meth. June 5, 12; Heine, July 3, Sep. 10; sectional and shell, rel. econ., Buel, July 16; trials, Indus. Elec. exhib., '84, July 23; Babcock, table, Sep. 24; elec. light, tests, Wagner, Nov. 12, 19; commercial value of stm. coals, Nov. 26; Jarvis Eng. Co. Dec. 3; trials, with Stevens fur., Galloupe, Dec. 17-**5**; fur. effic. with different coals, Jan. 7; Harrisburg elec. light. cen. station., Pa. Jan. 7; water-tube b. Apr. 22; Root b. May 6; econ. (50 per cent), May 13; at Dessan sugar ref. Oct. 13; Phil. water dept. Dec. 15-**6**; fur., forced combust. expts. at Wash. navy yd. Jan. 26; Galloway b., Edgemoor I. Co. Mar 16, 30, Apr. 6, 13, 27-**7**.

" BOILER TESTS, Brush elec. light wks. *Van Nost.* Jan.-**3**; evap. power anthra. coal in, Kent, Aug.-**4**; testing, evap. of water from and at 212° F., Buel, Feb; standard, rep. Mar, Apr.-**5**; n. Aug.-**6**; *Fran. Inst.* May; and st. b's, rep. July-**5**; Kingsley, rep. Oct.-**6**; furs., downward-draught, Lozano, Nov. Dec.-**7**; Babcock b., Edison Co. *Elec. Rev.* Jan. 3-**5**; at Nashville, J. W. Hill, *Sci. Am. Sup.* Dec. 18-**6**; calorimeter, *Locom.* Feb; evap. power and effic. Oct.-**5**; Am., effic. of, Fran. Inst. rep. *The Eng.* Sep. 4-18-**5**.

" BOILER water gauge, connections, *Mech.* Jan 26; Bertrand, Apr. 5; do. Apr.-**4**; glass, Summerson's, *The Eng.* Apr. 3-**5**.

" CALORIMETER, Barrus, *Iron Age*, Dec. 10-**5**; do. *Am. Eng.* Oct. 31-**4**; do. Dec. 3-**5**; Grizzi, *The Eng.* June 1-**3**.

" CARRIAGE, Bollee's, *Sci. Am. Sup.* Aug. 18-**3**; Dec. 17-**7**.

" CHECK VALVE, spherical, Labeyrie's, *Am. Eng.* Mar. 9-**7**.

" ENGINES. See also MARINE AND PUMPING ENGS; RAILROAD LOCOMOTIVES.

" ENGS., cyl. condens., loss by, Emery, *Eng. News*, Nov. 27-**6**; high speed motor, Cockburn, Aug. 6-**7**; Davis, *Iron Age*, Jan 18; English mint, Mar. 1; Ide, Dec. 20-**3**; and gearing for elec. light, Fithian's, Jan. 10; inventions of Watt, Jan. 31, Feb. 7, 14; early hist. May 1-29, June 5; early, Trevithick's, Dec. 25-**4**; and gov., Nystrom's high-speed, Feb. 5; cutoff gear, Topmiller, Apr. 2; Trenton, May 7; oscillating, Moore, June 18-**5**.

STEAM ENGINES, reversing valve, Moore, *Iron Age*, July 2; high-speed, Fielding, Sep. 17; Shipman, Oct. 8; cyls., non-conducting, Nov. 26; Grasshopper, English, 1815, Dec. 10-5; condensing, air valve, Losenhausen's, Mar. 25; aut. cutoff, Man, Apr. 1; Webster, Lane Mach. Co., Akron, O. Apr. 15; slide valve friction, June 3; compressed hot air in, July 15; Proell's high-speed, Nov. 4; Ide, Nov. 18-6.

" ENGS., high speed comp. for elec. lighting, Swiss, *Iron Age*, Jan. 13; slide valve friction, Feb. 3; flywheels, strength of, Feb. 3; winding, double cyl., Copeland, Feb. 3; piston rod packing, Rohn, Feb. 17; blowing, Wermer, Mar. 17; beam, compounding, Mar. 31; valve movement, Coryell, May 26; comp. single cyl., Richards, June 9; cyl. condens. and comp. engs., Emery, June 16; oscillating, valve gear, Hartley, Oct. 6; high-speed, "climax," Oct. 6-7.

" ENGS., slide valve, Church, *Mech.* Jan.-6; direct acting, Davis, Jan. 6, Feb. 17; slide valve, Morsop, Jan. 13; for English mint. Mar. 3; comp., advantages, May 12; do. Porter-Allen, May 19; do. single cyl., Richards, June 2; cyl. jacketing, for hoisting eng. and stm. hammer, June 9; valve, circular D, June 16; connecting rods, June 23; vertical, balanced, Durfee, June 30; comp., Riedinger, Aug. 4; do. Shanks, English, Aug. 11; and gov., Ball, Aug. 11; valve diags., Rose, Aug. 18, Sep. 1; do. Zeuner, Sep. 29, Oct. 13; spherical, Tower, Sep. 8; condenser, Korting, Sep. 29; cutoff cams, Jordan, Oct. 6; vertical, balanced, Durfee, Oct. 6; comp., econ. of, Rudiger, Oct. 6, 13; valve motion, Angstrom, Nov. 24; governing by compression, Tabor, Dec. 1; Ide, Dec. 15; high-speed, Jacomy, Dec. 22; and gearing, Fithian, Dec. 29-3.

" ENGS., valve gear, Laharpe, *Mech.* Jan. 19; semi-port., Lane, Feb. 2; hor. condens., Ludwig, Feb. 9; 6 H. P. Farcot, Paris, Feb. 9; valve, balanced, Rund, Feb. 16; comp., Willans, Mar. 1; condensing water, table, Mar. 29; winding valve gear, Mayer, Apr. 5; high-speed, Parson, Apr. 19; Corliss, Schneider, Creusot, France, Apr. 26; winding, aut. cutoff gear for, Mayer, Apr; condensing water for, table, Aller, Apr; early hist., Dubois, Apr. 26, May 3-31; high-speed, equalizing action of recip. parts, June 14-28, July; reversing gear, Boutard, June 14; hor., Kliebisch, Chemnitz, Saxony, Aug; vertical tandem, surface-condensing, Dec.-4.

STEAM ENGINES and gov., high-speed, Nystrom, *Mech.* Jan; high press., Trevithick's early, Crewe Ry. wks. Jan; crank shafts, strength, Feb; cutoff gear, Topmiller, Feb; piston packing, spring, Flanders, Apr; Trenton, May; single acting, Richards, May; oscil., Moore, June; cutoff valves, June; compression in, Rose, Aug; high-speed, Fielding, Sep; condensing water, cost of, Sep; Shipman, Oct; semi-portable, with elec. gov., English, Oct; Grasshopper, English, 1815, Nov; cyls, non conducting materials in, Emery, Dec.-**5**; condens., Nolet, Feb; slide valve and piston position, Mar; crank shafts (lining), n. May; piston packing ring thickness, Rutherford, sup. June; cyl. condens. and comp. eng., Emery, sup. June; valve gear, Allan, June; condenser, surface, Lighthall, June; valve gear, Swain's universal, Oct.-**6**; building, labor in, Fitch, July; triple expan., Suplee, Nov; piston packing, Sweet, Dec; non-condensing, internal friction of, Thurston, Dec; valve gears and govs., Fitch, Dec.-**7**.

" ENGS., Tandler's, *Am. Eng.* Feb. 1; slide valve, balanced, Delancey's, Mar. 14; most econ. May 2, 16-30; Ide, June 13; Estes, Aug. 29; comp., Turner's, Sep. 19; cyl. lub. Nov. 7-**4**; hist. "steam jack," Mar. 13; parts proportioning, Apr. 10; Ide, Apr. 17; comp. and non-comp., relative econ. Feb. 20, Apr. 24, May 15; Trenton, May 8; slide valve, balanced, Schuhmann, July 10; eccentric, spherical, Tripier, Poillon, Sep. 3; valve, Carlson's, Dec. 24; econ. aut. cutoff, Corliss, over plain slide valve, Dec. 31-**5**.

" ENGS., Porter-Hamilton, *Am. Eng.* Feb. 18; rolling mill, Joliet Steel Co.'s, Mar. 11; Chuse, Mar. 11; Taylor Mfg. Co. Apr. 1; balanced rotary valve, Glenn, May 6; cals., formulas, May 6; crank pin, strength, May 20; balanced valve, Bal. V. Co. July 14; Fishkill Corliss, Nov. 10; crank shaft twisting moment det. by graph. meth., Hollis, Dec. 8; non-condens, friction of, Thurston, Dec. 8, 15-**6**; valve movement, Coryell's, May 18; friction of non-condens., Buel, June 8, 15; comp., Williams, July 6; contin. expan., Henderson, Aug. 10; Corliss, Reynold's wrt. iron frame, Aug. 31; Russel, Nov. 16; piston packing, Sweet, Nov. 23; Valley, Dec. 14; non-condens., internal friction of, Thurston, Dec. 14-28-**7**.

" ENGS., Armington & Sims cutoff, *San. Eng.* Apr. 19-**3**; hoisting and derrick, Equit. bu., N. Y. *Eng. & Bu. Rec.* Mar. 26-**7**.

STEAM ENGINES, stopping ap., German, *Ry. Gaz.* Sep. 9-**7**; slide valve back press., Robinson, *Van Nost.* July; 2-cyl. comp., do. Oct, Nov.-**3**; comp. and plant, Buel, May, and b. June-**4**; cushioning in, Morton, June-**5**; triple-expan. Apr.-**6**; non-condens., friction of, Thurston, *Ry. & Eng.* Feb; comp., King, Mar; do. Borries, Mar; slide valves, power required to move, trial, Giddings, Apr.-**7**.

" ENGS., commercial and dynamic efficiencies, *Fran. Inst.* Oct; valve motion, new radial, Dec; cutoff, cheapest point, Dec.-**3**; do. do .Feb, May, June, July; comp., econ. Jan, Apr; cyl. condensation, Jan, Mar, Apr; expan. and size, econ. July; theory, development, hist. Oct.-**4**; cyl. jacketing, Sep; do. behavior of stm. in, Dec.-**5**; Porter-Allen, Buckeye, rep. Feb; cyl. condens. and expan. Feb, May; inertia recip. parts and effect on crank pin, Sep; non-condensing, friction of, Dec.-**6**; triple-expan., Henderson, Nov.-**7**.

" ENGS, Corliss, *Electric.* Apr.–June; do. and Wheelock, July; Greene, Aug; Porter-Allen, Sep; Buckeye and Hartford, Oct; Cummer, Nov; Straight Line, for elec. lighting, Thurston, Dec.-**3**; Armington, Jan; Ball, Feb; Ide, Mar; Ericsson and Westinghouse, for elec. lighting, Thurston, Apr.-**4**; Davey vacuum, safety, Aug.-**5**; Buckeye, *Elec. Rev.* Dec. 20-**3**; Fitchburg, Jan. 24; Reynolds-Corliss, Jan. 31; Ide, Feb. 21-**4**.

" ENGS., Cowdrey 4-cyl., without dead centers, *Elec. Rev.* Feb. 14-**5**; N. Y. Safety Stm. Power Co. Jan. 23; Burnham, Mar. 27-**6**; and gov., Russell, Nov. 19-**7**; Ide, *Elec. World*, Jan. 26, Feb. 2; Ball, Feb. 23, Mar. 1; Harmon, Gibbs, Apr. 5; Straight Line, Dec. 20-**4**; Kriebel's oscil. Feb. 28; N. Y. Safety Stm. Power Co.'s, Mar. 21; Fitchburg, Apr. 18; Fithian, May 2; Shipman, Aug. 22; Ide, Sep. 5-**5**; H. P. of, Rose, Jan. 9; Burnham's, Mar. 27-**6**; Woodbury, Rochester, July 30; Russell, aut. Nov. 19-**7**.

" ENGS., comp. vert., Farcot's, *Sci. Am. Sup.* Jan. 6; hor., Sulzer's, Mar. 3; origin, hist. Apr. 28; Farcot's imp. Woolf comp. June 9; Ridcalgh's, high-speed, Aug. 11; Allis' Twin. Sep. 22; Tower's spherical, Sep. 22; vert. and hor. comp., Bietrix's, Sep. 29; valve gear, Laharpe's distrib. without eccentrics, Nov. 17-**3**; 6 H. P., Farcot's, Jan. 26; Abraham 4-cyl. Feb. 2; Ide, Feb. 16; Tower spherical, May 3; and generator, Friedrich & Jaffe's, Nov. 15; vert. tandem comp. surface condens., Worth, Dec. 27-**4**.

STEAM ENGINES, Trevithick's high press., at Crewe, *Sci.Am.Sup.* Jan. 3; comp. condens. tandem, Simpson, Jan. 24; comp., Willans', and elec. gov. Feb. 28; balancing recip. parts of, Seymour, Mar. 7; high-speed, Mar. 21; do. Fielding, July 11; do. Jacomy's motor, Sep. 19-5; hor., with Proell valve gear, Apr. 24; vert., Friedrich, May 29; high-speed, Porter, June 19; comp. compared with high press. condens. eng., Walton, Aug. 28; slide valve des., R. H. Smith, Dec. 25-6; beds, asphalt masonry, Feb. 19-7; non-condens., friction of, Thurston, *Locom.* Nov, Dec.-6; high-speed, principles of, Porter, *Soc. Arts*, Nov. 9-2; Cummer, H. A. Hill, Mar. 8-3.

" ENGS., comp. hor., Rudinger's, *Eng.* Jan. 5; do. Hayward Tyler, Apr. 6; experimental, Mason, Sci. Coll., Birmingham, Feb. 23; non-condens. Apr. 13, 27; Ridcalgh's high-speed, June 29; comp., Glasgow, Aug 24; do. valve gear, Goodfellow, Oct. 5. do. at Statybridge spinning mill, Sep. 14, Oct. 5; hor., Yeddo, Japan, Nov. 9; Abraham's 4-cyl. Dec. 21; comp., for Ind. States Ry. Dec. 28-3.

" ENGS. hor. condens., Lowe, Berlin, *Eng.* Jan. 4; piston, Maclaine, Jan. 11; comp., for elec. lighting, Willans, Jan. 25; do. for dynamos, Prager, Feb. 1; high-speed, Parson, Mar. 14; cutoff gear, Proell, Mar. 21; Tower, spherical, Mar. 7, May 21; eccentrics, spherical, Tripier, May 30; wall, Tangye, June 13; comp. hor., Dacca Twist mill, Manchester, June 13; eccentrics, reversing, July 4; aut. barring, Hick, Aug. 22; cutoff gear, Low, Sep. 12; hor., Craig valve gear, Oct. 3; Trevithick's high-press., Crewe, Nov. 21-4.

" ENGS., high-speed, Chandler, *Eng.* Jan. 16; piston packing, spiral, Durham, Mar. 13; comp., receiver, Willans, Apr. 17; Wheelock, Inv's exhib. May 1; high-speed at, do. May 1; Tower spher. May 1; high-speed, Fielding, July 31; valve gear, differential, Davey, Sep. 4; Corliss, Inv's exhib. Sep. 11; high-speed, Welford, Oct. 16; blowing, Liker, Hungary, Oct. 30, Nov. 13; comp., and Lond. Port. Cement Co.'s, Ormerod, Nov. 27; with Morton's ejector condenser, Dec. 11; vert. comp. mill, Douglass, Dec. 25-5.

" ENGS., air compressing, Manchester, *Eng.* Feb. 19; comp. tandem, Joicey, Feb. 19; hor,, Proell valve gear, Mar. 12; high-speed, Apr. 16, July 2; hor., Hertay's expan. gear, Brabant, June 18; do. Stevenson, July 9; Westinghouse, Aug. 13; valve gears, radial, Sep. 17, Oct. 8-6.

STEAM ENGINES, triple-expan., Edinb. exhib. *Eng.* Oct. 15; do. hor. comp. Oct. 29; Marchant, Oct. 22, Nov. 5, 12; mill, inverted cyl. Nov. 26; comp., King's, Dec. 24-6; beam, compounding, Bagshaw, Mar. 11; "Climax" motor, Apr. 1; distrib. of heat in, T. English, July 8-22, Oct. 7; oscil., valve gear, Hartley, Sep. 16; comp. condens. tandem, Powell, France, Nov. 11; Seller's comp., single crank, Nov. 25; do. Dec. 30; comp. Dec. 30-7.

" ENGS., comp., Royal mint, *The Eng.* Jan. 19; valve gears, radial, Graham, Feb. 23, Mar. 30; do. diagrams, Falkenburg, Mar. 30; for elec. lighting H. of Parliament, Mar. 16; non-condens., cals. Apr. 6, 20; on wrt. iron bed plates, Tyler, Apr. 13; hor. comp. 400 H. P., Stothert, June 8; valve gear, Morton's, July 6; condenser, Kirkaldy's, July 6; hor., Davey, Sep. 28; at Smithfield C. Show, Dec. 14; comp., Ind. State Rys. Dec. 28-3.

" ENGS., comp. and centrif. drainage pump, Hathorn, *The Eng.* Feb. 22; hor. condens., Woolwich arsenal, Apr. 11; at Health exhib., sup. May 9; reversing gear, Boutard's, May 16; vert. comp., Ind. St. Rys. Aug. 1; slide valve, balanced, Tipping's, Aug. 1; comp. tandem, Whitmore, eng. Sep. 12; Straight Line, Oct. 3; Westinghouse, Oct. 31; vert. tandem, Worth, Nov. 7; comp. triplex, Goodfellow, Nov. 28; comp. condens. tandem, Simpson, Dec. 19-4.

" ENGS. fly-wheels, R. H. Smith, *The Eng.* Jan. 9; slide valve friction, Tower's expts. Feb. 6; slide valve, Peck's relieved, Feb. 27; do. friction relieved, Mar. 5; Trossin's superheated stm. Mar. 27; Kriebel's, Apr. 10; valve gear, Fletcher's, Apr. 17; at Invs. exhib. May 8, 22; 25 H. P. Wheelock, May 8; high-speed, Parson's, May 8; Goodfellow & Matthew's, May 8; Chandler's, May 22; hor. comp. condens., Stothert, eng. May 29; lead in, May 29; valve gears, radial, Graham, June 5; Fielding's high-speed, June 5; 50 H. P. hor., French, June 19, 26-5.

" ENGS., effic. of, *The Eng.* July 8; 50 H. P. vert. comp. mill, Spencer, eng. July 10; at Agric. Show, July 17; Robey's, with Proell's valve gear, Invs. exhib. Aug. 7; Mather's diagonal, Aug. 7; grasshopper, Birmingham, Aug. 14; Climax vert. Aug. 28; and b's, straw burning, Garrett, eng. Sep. 4, 4; at Antwerp exhib. Sep. 18; piston valves, Thom's, Oct. 16-5.

STEAM ENGINES, 400 H. P. Corliss and valve gear, *The Eng.* Nov. 6; comp., cutout in large cyl. of, R. H. Smith, Nov. 27; do. at Inv's exhib. Dec. 4; do. 1st Ave. hotel, Dec. 11; condens., Antwerp exhib., Bollinckx, eng. Dec. 18, 18-5.

" ENGS. 20 H. P. condens., Antwerp exhib., Nolet, eng. *The Eng.* Jan. 1; vert. tandem comp. surface condens., Worth, Jan. 8; 150 H. P. hor., Hick, Jan. 22; comp., expan. in, Jan. 29; slide valves, Westgarth, Feb. 5; cyl. condens. Feb. 26; hor., English, Feb. 26; Am. Mar. 5; cals., Unwin, Apr. 9; slide valve, equilibrium, Bate's, Apr. 23; high-speed, obscure influences of reciprocation in, Rigg, June 4; vert. Corliss, July 2; Edinb. exhib. July 16; dead points, Oct. 1; hor. quick speed, Proell, eng. Oct. 22; Marchant, Oct. 29, Nov. 5, 12; slide valve des. R. H. Smith, Nov. 5; high-speed, and dynamo, Greenwood, Nov. 12; cyls., condens. in, Nov. 19; fly-wheels, strength of, Nov. 19; single acting, effic. of, Dec. 3, 10; double cyl., elec. light, Robey, eng. Dec. 10; hor. with single Proell cutoff gear, Dec. 10; Castle, vert. cyl. Dec. 17-6.

" ENGS., Quernel, high econ. *The Eng.* Jan. 28; cyl. condens. Feb. 4, Bodmer, 4, Mar. 4; non-condens., friction of, Thurston, Feb. 4, 25, and pumps, 6 H. P., Ind. St. Rys. Mar. 4; for elec. light, Manchester exhib. June 3; econ. July 1; comp. flour mill, July 15, 22; do. Southwark & Vauxhall water wks., sup. July 22; do. vert., Ind. St. Rys. Sep. 2-16; do. cyl. metallic packing, Jerome's, Oct. 7, 7; valve and gov., Horton's aut. cutoff, Oct. 14; comp., Bever's, Dec. 23; do. mill, 1,000 H. P., Buckley, eng. Dec. 23-7.

" ENG. brake, Prony, *Mech.* Apr. 14-3; do. friction, Beer, May 17-4; do. do. Buchetti, Mar.-5; dynamometer, slide valve, Giddings, *Am. Eng.* July 7-6; and b. fuel economizer, P. Barnes, *Eng. News*, May 30-5.

" ENG. GOVERNORS, shaft, Ball, *Iron Age*, Dec. 29-7; do. do. *Mech.* Dec.-7; aut. cutoff, Vienna exhib. Oct.13; aut. throttling, do. Dec.8-3; Ganz, Mar. 29; Wright, Apr. 19-4; Waters, *Am. Eng.* Feb. 1; expan. reg., aut. Aug. 29-4; elec., Ide, Oct. 22-5; Von Liede, inv. Feb. 4-6; and speed recorder, Hayne's kinemeter, Apr. 27-7; elec. *Elec. World*, Dec. 12-5; shaft, Ball's, Dec. 10-7; speed regulators and hydr. motors, *Sci. Am. Sup.* Aug. 4-3; elec., Willans, Feb. 28; do. Jamieson's, Mar. 21; "Cat," May 16-5.

STEAM ENG. GOVERNORS, *Eng.* May 25-3; Ganz, Jan. 18; Moscrop recorder, Knowles, May 16; Tangye, June 20-4; McFarlane, Nov. 27-5; Liede, Jan. 1-6; Lindley's, *The Eng.* Oct. 24-4; theory of, Brunton, Jan. 2; Napier's "Cat," Apr. 10; speed regulation, elec., Willans, Apr. 24-5.

" ENG. INDICATORS, Richards, foreign modifications, *Mech.* Jan. 20; power measurement, Macgovern, Jan. 27; card errors, Rogers, Mar. 17; Apr. 7; motions, Nystrom, June 2, 9, Aug. 11; ap., Parks, Sep, 1-3; Shaeffer, Mar. 8-4; diags., errors in, Reynolds, Sep; novel, Nov.-5; diag. measuring, Grimshaw, July-7; 3 types compared, Barrus, *Am. Eng.* June 6-4; applic., table, Nov. 26-5; diags. Jan. 14, Feb. 4-6; rigs, *Fran. Inst.* July-3; do. May; cards, Oct.-4; Amice, *Sci. Am. Sup.* Jan. 17-5; Crosby, *Eng.* Feb. 29-4; diags. June 12-5; rigs, Grimshaw, *The Eng.* Aug. 24-3.

" ENG. LUBRICATORS, Schonheyder's, *Mech.* May 10-4; do. *Eng.* Apr. 11-4; do. *The Eng.* Apr. 11-4; Craig's, *Am. Eng.* Feb. 8-4; Mollernp's, *Sci. Am. Sup.* Nov. 22-4.

" ENG. MAKERS SOC. *Eng.* Oct. 5-3; rep. June 6-4; power meter, Boys (Liverpool Eng. Soc.), *Eng. News*, Mar. 15-4; speed recorders, Hayne's kinemeter, *Am. Eng.* Apr. 27-7; variation registering, Anthony, *Electric.* Dec.-6; Moscrop's contin. fluctuations, *Elec. World*, May 10-4; do. Knowles, *Eng.* May 16-4; do. May 1-5.

" ENG. TRIALS, stationary, tests, Barrus, *Eng. News*, Nov. 13-6; stm. consumption per H. P., Williams, *Mech.* Aug. 25-3; tests, Hill, *Van Nost.* Feb; do. Barrus, Sep.-6; comp. condens., Alsace Ger. *Fran. Inst.* Oct; cyl. condens. expts. Oct.-Dec.-5; testing in 1849, *Eng.* Feb. 15-4; University Coll. Oct. 2, 9-5; comp. non-condens., trial of, Nov. 26; expts., Donkin, Nov. 5, Dec. 3-6; Newcastle, July 22; Royal Agric. Soc. do. Nov. 11, 18, Dec. 9, Appold brake, 16, 16; n. Dec. 30-7.

" ENG. TRIALS, wt. of stm. indicated and wt. water vaporized in cyl., difference between, Isherwood, *The Eng.* Jan. 4-4; Corliss, at Creusot, Feb. 27, Mar. 6, 20, 27, Apr. 17; hor. comp. tandem, test, Longridge, rep. July 3-17; comp. condens., at Mulhouse, econ. of, Isherwood (Fran. Inst.), Oct. 2, 2, 9; condens. in cyl., expts., Gately, Oct. 30, Nov. 6, 20, 27, Dec. 25-5; do. do. Jan. 29-6; distrib. of heat in stm. engs., expts., T. English, July 1-7.

STEAM ENG. TRIALS, tests at Newcastle, *The Eng.* June 24, July 15, 22, Aug. 5, 19; Agric. Soc's Show expts. Nov, 18, 25, Dec. 2; testing ap. McLaren's, Dec. 2; do. brake, Dec. 9; Dec. 9-**7**.

" ENG. WORKS, Peter Brotherhood's, London, *Eng.* Apr. 27, July 20-**3**; and shipyard, Napier, Govan, Sep. 18; John Cockerill Co., rep. Oct. 16-**5**.

" ENGINEERS, exam. ordinance for, *Fran. Inst.* Feb.-**4**.

" GAUGE, tester, Ruchholz, Ger. *Mech.* Mar. 31; connections, Dec. 22-**3**; recording, Edson, *Am. Eng.* Nov. 28-**4**; Bourdon, Cooley, Jan. 23-**5**; recording press., Hague, *San. Eng.* July 30-**7**; air-spring press., Allan, *Eng.* Jan. 7-**7**; Budenberg's, *The Eng.* May 8-**5**; Allen's, Feb. 26-**6**.

" HAMMER, who invented, *Eng. News*, Jan. 24-**5**; origin, Nasmyth, *Mech.* Mar. 17-**3**; Dick's, Stevenson, Scotland, Aug.-**5**; 10-ton, *Sci. Am. Sup.* Mar. 15; at Darlington forge, Oct. 18-**4**; 100-ton, Creusot wks. May 9; Dick's, June 27-**5**; do. *The Eng.* May 15-**5**; 10-ton, Feb. 8, 29; at Darl. forge, Sep. 5-**4**; Banning's, Sep. 9-**7**.

" HEATING. See also HEATING; C. A. Smith, n. *Eng. News*, Jan. 22; plant data, Jan. 29; overhead pipes, Mar. 5-**7**; for mach. shops and manuf. estabs. *Iron Age*, Sep. 6, 13-**3**; piping drip receiver, May 22; overheat, for mach. shops, Dec. 18-**4**; vs. hot water, Emery, July 21, 28; data, Wolff, Sep. 1; radiators, cast vs. wrt. iron, tests, Hogan, Oct. 13-**7**; of bu's, Am. practice, Briggs, *Mech.* May 12, June 23; Am. May 19, 26, June 2-16; do. Rigg, Aug. 4, 11; mach. shop, Aug. 18, Sep. 1; long dist., Carpenter, Dec. 29-**3**; receiver for water from drip pipes, May 17-**4**; ap. May; exhaust stm. May, July; Station B chimney, N. Y. Stm. Co., Emery, July-**5**; and power transmiss., compar. value stm. and hot water for, Emery, sup. June; and ventil. office bu., Snell, Dec.-**7**.

" HEATING, and ventil. New bu., Mass. Inst. Tech., Woodbridge, *Am. Eng.* July 4; by overhead pipes, Dec. 12-**4**; flow of stm. thro. pipes, Babcock, July 10; heater, Plummer, July 23-**5**; reduced press. sys. Sep. 8-**6**; Wolff, Sep. 14-**7**; of stores, *San. Eng.* Jan. 4; and fitting, Jan. 18, Feb. 15, 22, Apr. 5, 19, May 24; supply, N. Y. Stm. H. Co. Feb. 1, 25; warmiug churches, Mar. 1, 22; of bu's, Am. practice, R. Briggs, Apr. 5, 12, May 24, 31; June 7, 7, 14, 28, July 5-19, 28, Aug. 9, 30, Sep. 20, Oct. 4, 25, Dec. 6; and ventil., Met. Op. h. N. Y. Dec. 13-**3**.

STEAM HEATING, *San. Eng.* Jan. 3-24, radiator connections, 24, Feb. 21, Apr. 3, 10, May 1, June 5, 26, July 24; and ventil., Bridgeport hos. Feb. 14; N. Y., selling by wt. June 19; and fitting, June 5, 26, July 24, Sep. 4, Oct. 16; and ventil., Mass. Inst. Tech., Woodbridge, Oct. 30, Nov. 6-4.

" HEATING ap., Mut. Life Ins. bu., N. Y. *San. Eng.* July 23; and ventil. ap. as used on continent, details, Sep. 10; do. results at Mass. Inst. Tech., Woodbridge, Sep. 17, 24; water line sys, Oct. 1; comparative value of metal surfaces for warming air, Baldwin, Nov. 26; and fitting, June 4, Dec. 3-24-5; do. Mar. 11, Apr. 15, June 3, Aug. 12; combined receiving tank and pump gov. Mar. 18; grav. ap., desirability of, when coils are only 14 inches above water line, June 10; amt. of stm. for given radiator surface, July 1; and ventil. in Royal Holloway Coll. Aug. 5; b. for h. warming, Sep. 9; stm. trap, Sep. 23; relative cost of one and two pipe systems, Nov. 13; imps. in, Tudor, Dec. 18-6; Equit. Life Ins. bu., N. Y. *Eng. & Bu. Rec.* Oct. 22, Nov. 19-7.

" HEATING of shops, Sturtevant sys. *Ry. Gaz.* June 10-7; Am. practice, Briggs, *Van Nost.* May, June-3; pipes, loss of heat from, *Ry. & Eng.* Sep.-7; of horse cars, Gold sys. *St. Ry. Gaz.* Aug.-6; of bu's from a central source, Bartlett, *Sci. Am. Sup.* May 2-5; compar. value of stm. and hot water for transmiss. of heat and power, Emery, *Sci. Am. Sup.* Oct. 15; by exhaust stm., C. H. Manning, Oct. 29-7; receiver for water from drip pipes, *Locom.* Apr; hints, Nov.-4; and ventil., New Bu., Mass. Inst. Tech., Woodbridge, *Soc. Arts*, May 22-4; imps. in, Tudor, Nov. 12-5; of bu's, Holly's sys., Bartlett, *The Eng.* Oct. 10-4; ap., Lan. & York. Ry., Manchester, Dec. 17-6.

" INJECTORS, Morse inspirator, *Mech.* Nov.-5; exhaust, *Ry. Gaz.* Nov. 4-7; do. *Am. Mach*; do. *Eng.* Apr. 18-4; do. Hamer, Holden, Davies, May 1-5.

" JACK, *Sci. Am. Sup.* Apr. 18; hist. of, June 6-5.

" METERS, *Mech.* Apr. 14-3; (heating bu's by stm.), Bartlett, *Sci. Am. Sup.* May 2-5.

" MOTOR, oscil., for pump, *Sci. Am. Sup.* Mar. 17-3.

" PIPES, coverings, non-conducting, *Iron Age*, Mar. 17-7; check valve, Pratt's straightway, *Mech.* Nov. 3-3; thermom. *Am. Eng.* June 1-7; fittings, cast iron dimen. scale, *San. Eng.* Apr. 26-3.

STEAM PIPES, and gas pipes, wrt. iron, standard threads for, Briggs, *Eng.* Nov. 20-6; water hammer in, *Fran. Inst.* July; coverings, non-conducting, Dec.-3; radiation and covering effic., expts. *Locom.* Jan; hangers, Nov, Dec; long, expan. joints in, Dec.-7; coverings, Ordway, *Soc. Arts*, Nov. 8-3; and b. coverings, non-conducting, *Eng.* Feb. 16; do, compositions, Sep. 21-3; do. Ordway, Feb. 27-5; do. ap. testing, *The Eng.* Jan. 25; do. expts., Ordway, May 23-4.

" PRESS. REGULATOR, Curtis, *Iron Age*, Sep. 13-3.

" PUMPS, Davidson, *Eng. News*, Feb. 10-3; Lawrence Mach. Co: May 7-7; valve gear, Harlow's, *Iron Age*, Oct. 9; Ide, Nov. 6-4; Carricaburn, Jan. 28; Empire, Feb. 11-6; piston, Wetherell, Apr. 21; double acting power, Goulds Mfg. Co. May 5; Schutte stm. jet siphon, Aug. 18-7; Ide, *Mech.* Oct; valve gear, Harlow, Oct.-4; condenser, Craig, Aug.-6; Knowles, setting up, Dec.-6; Harlow's valve gear, *Am. Eng.* Oct. 3; Hall's, Dec. 12-4; Nagle, Jan. 2; econ. of, table, Jan. 16; reg., Mason, Apr 17; Hall duplex, Nov. 12-5; do. June 8-7; Worthington, expts., Mair, Nov. 3-6; gov., Blessing's, Jan. 5-7; direct acting, expts. on, Mair, *San. Eng.* Nov. 6-6; valve motion, Harlow, *Ry. Gaz.* Oct. 10-4; Empire, *Elec. World*, Feb. 6-6; comp. Blake with condenser, *Eng.* June 29-3; Worthington, Nov. 14-4; do. fire exting. Nov. 13-5; direct acting ram, Pearn, May 22; well sinking, Warner, Invs. exhib. Oct. 23-5; Bernay's, *The Eng.* May 8-5. See also PUMPING ENGS.

" ROAD ROLLER, 20-ton, *Am. Eng.* Mar. 18-6.

" SEPARATOR, Boys', *The Eng.* Feb. 26-6.

" STAMP, Leavitt, *Iron Age*, June 11-5; do. differential, Cal. & Hec. copper mines, do. *Mech.* July-5; *Eng.* Jan. 29, Feb. 5; Leavitt, Feb. 26-6; Ball, Feb. 25-7.

" SURFACE CONDENSER, wheeler, *Mech.* Jan.-6.

" SYREN, Steven, *Eng.* Jan. 22-6.

" TABLES, comparative, Nystrom, *Mech.* Apr. 21-3.

" TRAP, expan., Curtis, *Eng. News*, Sep. 1-3; Lancaster, *Mech.* Jan. 20; Hawes, Aug. 18-3; Pratt, Jan. 19-4; Hawes', *Am. Eng.* Feb. 16-7; expan., Hyde's, *Sci. Am. Sup.* Apr. 11-5; McDougall's, *The Eng.* Dec. 23-7.

" VALVE, balanced, Glenn Co. *Iron Age*, Apr. 5-3; straightway, Cincin. Brass wks. Jan. 20; Wade, Feb. 17-7; press. reducing, Acme, *Mech.* Jan. 20; bal., Glenn Co. Apr. 14-7.

STEAM VALVE, Mason reducing, *Ry. Gaz.* Mar. 4-7. See also STEAM ENG.

" WINDLASS, and steering gear, *Eng.* July 27-3.

STEEL. See also IRON AND STEEL; strength and elas., Christie, *Eng. News*, May 17; openhearth manuf., Riley, Nov. 1; soft, effect of punching holes in, expts., Guerhard, Dec. 13-4; future of, May 9; Clapp-Griffiths proc. June 27-5; testing, Collingwood, Jan. 16-6; properties, use in guns, Mar. 26-7; wks. soaking pits, *Iron Age.* Jan. 18; castings, gases in, Muller, Jan. 25, Mar. 15; do. Parry, Mar. 1; structural, management, A. F. Hill, Mar. 22; bess. converter, chem. of, Stead, Apr. 12; wks. furnaces, Siemens-Martin, Graz wks., Aus. Apr. 19; hardening and softening, May 31; bess. ingot cranes, G. Curtis, June 28; wks., hydr. cranes for, Oct. 25; carbon in, color test for, Oct. 25, b. plate, openhearth, tests, Oct. 25; bess. plant, center crane for, Nov. 1; do. No. Chic. R. Mills, Nov. 1; crucible, proc., theory, Dec, 27-3.

" BASIC proc. at Creusot, *Iron Age*, Jan. 10; crisis, of world, Feb. 28; plant for cut nails, Riverside, W. Vir. Apr. 3; openhearth furnace for, Apr. 16; do. plant, Chester, Pa. May 22; wks., bess., Cleveland, June 5; do. Seraing, Ger. Aug. 28; bess., basic blow, Sep. 25; substitution for iron, Oct. 2, 9; open hearth, Oct. 16; furnace, largest in world, Oct. 16; crucible cast, manuf. Oct. 16; bess., Sweden, Oct. 23; lines of strain in, Nov. 13; bess., original plant at Troy, Nov. 20-4.

" BESS., basic proc. prog. *Iron Age*, Jan. 8; do. plant, Jan. 29; do. production, Feb. 26; high phos. Mar. 5; bess., English indus., '84, Mar. 12; do. converting h. Mar. 19; do. Avesta proc. Apr. 2; wks., stm. crane, St. Petersburg, Apr. 9; crucible proc., chem. reactions in, May 7; press, Whitworth, May 7; thick boiler plates, expts. May 7; mold for casting, Henderson, May 7; hardening by press. May 14; bess., English indus. May 14; wks., blooming mill, Ebbw Vale, June 18; bess., small wks. July 30; do., Wainwright plant, July 30; sources of supply of fine, Aug. 20; castings and forgings, Aug. 27; physical and chem. compos. Aug. 27; mild castings, Sep. 3; for ship bu. Sep. 3; wks., basic, Glengarnock, England, Sep. 17; castings, manuf. Oct. 1; do. solid, French, Dec. 10-5.

" TESTING, *Iron Age*, Feb. 4; bess. indus. of U. S. Feb. 18-6.

STEEL, bess. indus. of U. S., and iron and steel rail produc., '85, *Iron Age*, Feb. 18; making ladles, Feb. 25; and iron, effect of blue heat on, Feb. 25; afterblow in basic proc. Feb. 25; bess., basic pat., rep. May 11; ores of N. Car. May 6; bess., wk., unparalled, No. Chic. Roll. Mills, May 6; do. for rivets and structures, June 3; imports and prod., U.S. Aug. 5; compos. of basic bess. cinder, Sep. 2; wks. of U. S., capac. Sep. 2; manuf., Avesta proc. Sep. 16; Woehler's expts. Oct. 7; wks., Austrian basic bess. Oct. 14; ores and manganese of Barton cty., Ga. Dec. 16; German basic bess. wks. Dec. 23-6.

" BESS., U. S. produc., '86, *Iron Age*, Feb. 10; do. openhearth, do. Feb. 24; wks., Scranton Co. Mar. 10; melting furnace, Woolwich Ar., Radcliffe, June 23; tests, U. S. Govt. Aug. 18; openhearth melting fur., Lash, Sep. 8; manuf., use of aluminum in, Spencer, Dec. 22-7; structural, management of, A. F. Hill, *Mech.* Mar. 24-3; tests, Watertown, table, May 31-4; hardening by press. Apr.-5; July; tests, Felton, Dec.-7.

" BESS. plant at Troy, original, Hunt, *Am. Eng.* Nov. 21-4; manganese, Hadfield's, Jan. 16; bess. plant, Feb. 6; Clapp-Griffiths proc., Witherow, Apr. 10; forgings, Haswell & Whitworth, Egleston, May 8; openhearth, homogeneity of, Campbell, Dec. 17-5; castings, Maccallum, July 14-28; do. Gantt, Aug. 25; crucible cast tool, Styrian proc., Jacobs, Dec. 29-6; working, high grade, do. Jan. 5, 12; use in structures and heavy guns, Metcalf, Apr. 6, 13; strength of, May 25; basic, expts., White, Aug. 31-7.

" MILD, tests, Brit. Admiralty, *Ry. Gaz.* Feb. 8; manganese, Hadfield, Mar. 7-4; wks., new, U. S. Mar. 5-6; properties and use in heavy guns, Metcalf, Mar. 18; openhearth, U. S. and Grt. Brt., stat. Apr. 8; wks., bess., at Terin, n. Aug. 19-7; carbon in, Abel, *Van Nost.* Jan; for structures, Matheson, Apr; tempered, molec. rigidity of, Hughes, July; castings, secretion of gas in, Muller, July-3; do. do. Aug; carbon in, Mar; bess. indus., U. S. and Grt. Brit., n. May; cast. crucible, manuf., Seebohm, Dec.-4.

" MANGANESE, Hadfield, Weeks, *Van Nost.* Fob; basic openhearth proc., Gillott, Feb; resilience of, Lewis, May; Clapp-Griffiths proc. Sep; ingots structure, Walrand, Nov; bess., or Thomas-Gilchrist basic proc., rep., Patterson, Dec.-5.

STEEL, prob. *Van Nost.* Feb; behavior, May; and iron, injurious effect of blue heat on, Stromeyer, May; openhearth, blowholes in, Head, July; spec. grav. of low carbon, Garrison, Oct.-6; proper ties and use in structures and heavy guns, Metcalf, *Ry. & Eng.* Apr.-7.

" PLATE for b's and ship plate, U. S. Govt. cruisers, tests of, *Fran. Inst.* July-4; (bess.) metallurgy of, Sep; manuf., Clapp-Griffiths proc., Davy's, Gordon and Durfee converter, Nov.-5; imp., Schaefer's comp. Dec.-6; bess. proc., Henderson, June-7; tempered, molec. rigidity of, Hughes, *Sci. Am. Sup.* Mar. 10-3; manganese, Weeks, Aug. 2; crucible cast, manuf., Seebohm, Nov. 22; creators of age of, Bessemer, Siemens, Whitworth and Gilchrist, Dec. 6-4.

" RESILIENCE of, W. Lewis, *Sci. Am. Sup.* Apr. 18; b. plates W. Parker, May 23; Clapp-Grif. proc. May 23; mild, for naval and mil. purposes, Mackinlay, Sep. 5-5; making ladles, Mar. 6; plant, Davy, for small wks., Sep. 18-6; wks., So. Boston, Jan. 22; furnace, Radcliffe, Jan. 22; ingot to finished tool, Jacobs, Jan. 29; soft, fixed converter, Hatton, Feb. 19; proc., Henderson, Mar. 19; openhearth 'rapid' plant, Thwaite, Oct. 15-7; plate flanging, cold by hydr. press. *Locom.* May-3; converter, heat gen. in, June; making, Nov.-4; castings manuf., Salom, Nov.-5; openhearth produc., U. S., '86, Feb; facts about, Metcalfe, May-7; do. *Mech. Eng*; bess., blowing of small charges, latest development, Drown, *Soc. Arts*, May 27-6.

" TEMPERED, molec. rigidity of, *Eng.* Feb. 2; wks. furnaces, Siemens-Martin, Gray, Feb. 2; carbon in, Feb. 23; wks., engs. for, cogging and rail mill, Apr. 6; bess., castings, May 11; structural, June 22; wks., Cleveland, England, Sep. 28; center crane for bess. plant, Oct. 5-3; wks., hydr. cranes, Feb. 22; do. basic, Glasgow Iron Co. Mar. 14; do. bess., Helf, July 18, Aug. 1, 15, blowing eng. 22; crucible cast, Sep. 26, Oct. 10; openhearth, manuf. Oct. 3; wks., ladle carriage, Ebbw, Oct. 31-4.

" CARBON in, Abel, *Eng.* Feb. 6; do. expts., do. Feb. 20; wks. cogging mill, Ebbw Vale, Apr. 24; do. Glengarnock, Aug. 21; trade, Scotch, Sep. 4; wks., Scotland, Sep. 25; mild, for ship bu. Oct. 30-5; do. Apr. 23; plant, Clapp-Griffith, Apr. 2; castings, May 14, 21; plant, Davy, July 23; mild, annealing, Sep. 3; chem. of basic proc. Sep. 3-6.

STEEL, bess., proc. *Eng.* Oct. 15; do. converters, early, Oct. 15; b. plate, Nov. 5; for armor and projectiles, Dec. 31-6.

" WORKS, 5-ton ingot crane, Hallside, Glasgow, *Eng.* Jan. 21; do., Terni, Samuelson, June 10; do. No. Chic. Roll. Mill Co., Potter, June 3, 17; plate manuf., Riley, July 1, 29, Aug. 5; basic openhearth proc., Waites, Oct. 21; do. Harbord, Dec. 16-7.

" BESS., chem. of bess. converter, Stead, *The Eng.* May 11; wks., Cockerill, Seraing, July 27, 27; do. do., Liege, Aug. 3; carbon in, Dec. 21; openhearth proc., C. W. Siemens, Dec. 28-3; bess., indus. in. '83, Feb. 8; crucible cast, manuf., Seebohm, Sep. 26, Oct. 3, 10; openhearth, imps. in manuf., Riley, Oct. 3-4; and iron, injurious effect of blue heat on, Stromeyer, Feb. 26; Feb. 26; melting fur., Siemens, New Brit. Iron Co. Nov. 26; do., Royal Arsenal, Dec. 10-6; openhearth plant, Thwaite, June 10-7.

" CHAINS, *Eng.* Oct. 29-6; tubes, seamless, *Eng. News*, May 9-5.

STENCIL CUTTING, *Iron Age*, Dec. 1-7; *Metal Worker.*

STEREOSCOPE and applics., Himes, *Fran. Inst.* May, June-7.

STEREOTYPE PLATE MACH. *Mech.* June 28-4; Sauvee, *Eng.* May 16-4; do. Jan. 2-5.

STONE, BREAKER, Manden's, *The Eng.* June 19-5; Baxton's, Jan. 8; Mason's, Nov. 12-6; Lowry's, Dec. 23-7; do. *Eng.* Dec. 16-7. See also PULVERATORS.

" BUILDING, supply, granite quarries, Merrill, *Sci. Am. Sup.* Jan. 15–29-7; cutting, W. P. Trowbridge, *Eng. News*, June 23-3; mach., McDonald's, *Sci. Am. Sup.* Aug. 4-3; dressing and quarrying mach., Crump's, Mar. 27-6; Stone-Lewis, *Eng. News*, Jan. 23-6; resisting power to frost, *Am. Eng.* Oct. 22-5; saw, wire, helicoidal, Gay's, *Sci. Am. Sup.* Dec. 19-5; Auguste's, Nov. 19-7; working machs. Jan. 15-7.

STORMS, tornado, in Minn. *Ry. Gaz.* May 14-6; do. vel. and force of, Mees, *Ry. & Eng.* Oct.-7; whirlwind expts., Weyher, *Sci. Am. Sup.* Apr. 9-7; tornado study, Finley, *Locom.* June, July-6; typhoon at Manilla, Kneeland, *Soc. Arts*, Dec. 28-2; tornadoes, *The Eng.* May 21; Tay bridge, n. Dec. 10-6. See also WIND.

STOVES, German, *Iron Age*, Aug. 23-3.

STRAITS SETTLEMENTS, *Iron Age*, Nov. 5-5.

STRAW TRUSSING MACH. *Eng.* Dec. 14-3.

SUGAR, mach., and stat. of world, *Iron Age*, Nov. 27-4; in Europe and Am. Sep. 29-7; Florida, *Fran. Inst.* Sep.-5; evap. ap., Weibel, Piccard's, *Sci. Am. Sup.* Mar. 29; sorghum, Houck, May 31; cane decorticating mach., Faure's, June 14-4; milk, manuf., in Switz., Kunz, Feb; beet, manuf. ap. Nov. 14; beet juice extracting ap. by diffusion, Dujardin's, Dec. 12-5; manuf. filtering ap., Loze's, Sep. 25-6; evap. pan and mach., A. Smith, Glasgow, Apr. 23; cane manuf., diffusion plant for, July 23-7.

SUGAR, cane mill and eng. *Eng.* Aug. 24; refining, triple effect evap. ap. Sep. 28-3; Jan. 23-5; cane manuf. plant, diffusion, Hallesche, Ger. Mar. 11-7; factory, a great, *The Eng.* July 17-5; vac. evap. plant, A. & W. Smith's, Jan. 28, 28-7.

SUN, solar temp., Ericsson's pyrom. *Iron Age*, Nov. 13-4; do. do. *Mech.* Nov.-4; temp., internal, n. June-5; do. and motor, Ericsson, *Van Nost.* Mar; do. Wood, July, Nov; do. Gilman, Sep.-4; do. do. Jan, May; do. Wood, Feb.-5; do. surface Ericsson, Nov.-4; do. do. *Nature*; do. *Fran. Inst.* May-3; physical constitution of, Mar, Apr; motion of, Apr.-5; energy, storing, *Elec. Rev.* Aug. 2-3; fuel of, *Sci. Am. Sup.* July 14; solar physics, W. Siemens, July 21-3; temp. and motor, Ericsson's, Feb. 2; sunsets, red, Ringwood, Sep. 6; temp. surface and solar pyrom., Ericsson's, Oct. 11-4; wk., theory of radiant heat, Patten, Aug. 22, 29-5; heat, W. Thompson, Mar. 12, Dec. 17; light colors, Abney, May 28-7; energy, distrib. of, Langley, *Soc. Arts*, Jan. 25-3; sunshine recorder, Leckey, *Eng.* Sep. 5-4; heat, Dec. 4-5; solar pyrom., Ericsson's, N. Y., '84, *The Eng.* Oct. 31-4; sunlight, and earths atmos., Langley, Royal Inst. Apr. 24-5.

SWAMPS, of U. S., Shaler, *Eng. News*, Mar. 27-6.

SWEDEN, steel mauuf. in, *Iron Age*, Aug. 2-3; Swedish Bess. steel, Mar. 25-6.

SWEEPING AND ELEVATING MACH., March's, *The Eng.* July 31-5.

SWORD MANUF., at Solingen, Ger. *Am. Eng.* May 20-6.

TABLES, sqs., cubes and roots, 1 to 1,000, *Locom.* Apr.-3; areas circular segments, Dec.-6.

TALCOTT, ANDERSON, *Eng. News*, Apr. 28-3.

TELEGRAMS, transmiss. by pneu. tubes, *Iron Age*, Oct. 22-5.

TELEGRAPH, in U. S. *Iron Age*, Dec. 25-4; the world's telegraphs, *Mech.* July-5; do. *Ry. & Eng.* May-7.

TELEGRAPH, Delaney, Edison, Gray's, Western Elec. Co., rep. *Fran. Inst.* Mar.-**5**; of ancients, Bailey, *Elec. Rev.* Apr. 26; in Europe, table, Sep. 13, Nov. 8-**3**; origin, Oct. 4; use of storage bats. in, Preece, Nov. 1-**4**; telegraphing and telephoning simul. over same wire, *Elec. World*, May 23-**5**; do. *Sci. Am. Sup.* June 28-**4**; and teleph., Vienna exhib. *Eng.* Jan. 4-**4**.

" AUSTRALASIA, *Eng.* Mar. 28-**4**; aut., Am. Rapid, Leggo Aut. & Postal Co.'s, *Elec. Rev.* May 17-**3**; Teleg. & Teleph. Co., N. Y., rep. May 10, 17-**4**; fast speed, T. F. Taylor, *Elec. World*, May 24-**4**; Am. Rapid Co.'s sys. *Sci. Am. Sup.* Jan. 13-**3**; Balt. & O., prog. *Elec. World*, Nov. 29-**4**; in Belgium, '82, *Elec. Rev.* Sep. 20-**4**; Burke sys. *Electric.* June-**4**; cables, see TELEG., OCEAN CABLES; WIRES and do. UNDERGROUND; Chinese, *Fran. Inst.* Jan.-**4**; ciphers, *Electric.* Oct.-**5**; codes, *Elec. World*, Sep. 26-**5**; circuits, ground aut., Robbins, *Ry. Gaz.* Aug. 12-**7**; Kennelly, *Elec. Rev.* Nov. 5-**7**; companies liabilities for mistakes, Kirlin, *Electric.* Nov, Dec.-**5**; Feb.-**6**.

" DELANEY'S synchronous multiplex sys. *Iron Age*, Mar. 19-**5**; *Fran. Inst.* Jan, Sep.-**4**; fac-simile transmiss. Mar, Mar, June, Dec.-**5**; rep. Apr.-**6**; do. Aug.-**7**; Houston, *Electric.* Jan, Sep.-**4**; fac-simile, do. Apr.-**5**; *Elec. Rev.* Feb. 7-**4**; Phil. Elec. exhib. *Eng.* Oct. 31-**4**; do. Hughes, May 21-**6**.

" DISTRICT and fire alarm sys., McCulloh, Nov. 27-**6**; duplex, Wallace decis. *Electric.* Oct.-**5**; Edison phonoplex, see TELEG., PHONOPLEX; elec., Lockwood, *Electric.* Jan.-**6**; engineers, in India, *Eng.* June 26-**5**; do. resist. of faults in submarine cables, Kennedy, Apr. 8-**7**; do. Soc. pro. Jan. 30, Dec. 25-**5**; Mar. 5, 19, Nov. 19-**6**; June 10-**7**; fast speed, expts. *Electric.* Aug; do. Preece, Oct.-**7** aut., Taylor, *Sci. Am. Sup.* July 19-**4**; Preece, *Eng.* Sep. 16-**7**; field, without bat. *Elec. Rev.* Apr. 5-**3**; see also TELEG., MILITARY; first elec. *Sci. Am. Sup.* Mar. 15-**4**; first Am. underground, *Eng.* Dec. 18-**5**; foreign lines, stat. Dec. 24; France, Dec. 24-**6**; do. and post service organization, *Elec. Rev.* Aug. 9, 30-**4**.

" GOLD AND STOCK, printer, *Electric.* Jan.-May, Aug.-**3**; Co., Phelp's stock transmitter, Feb, May-**4**; govt. control of (salaries), *Elec. Rev.* May 31; govt. considerations, Price, May 3, 10-**3**; Green, *Elec. World*, Feb. 2-**4**; ground conductors, arrangement of, *Sci. Am. Sup.* June 14-**4**.

TELEGRAPH, history, A.Vail, *Electric.* Sep.-**7**; do. to 1837, Falne, *Elec. Rev.* June 7-**3**; early days of, Chapin, Apr. 24-**6**; simul. transmiss. of messages by one line wire, June 4-**7**; hist. of, in Am., pors. *Elec. World*, Feb. 27-**6**; do. *Sci. Am. Sup.* May 17, 31; do. early, June 14; Guerout, Aug. 16-**4**; do. Sep. 29, Oct. 6; origin of, Dec. 8-**3**; Feb. 23-**4**.

" HOUSE electro-phonetic, *Elec. World*, Nov. 20-**6**; instrums. *Elec. Rev.* June 21-**4**; inventor of, *Sci. Am. Sup.* Dec. 4-**6**; Leggo aut. and Postal Co.'s, *Elec. Rev.* May 17-**3**; Lesage's, *Sci. Am. Sup.* May 12-**3**; linemen and poles, *Elec. Rev.* Sep. 4-**6**; lines, of world, *Electric.* June-**5**; do. iron and steel wire for, relative merits, Preece, Sep.-**6**; do. pole, in N. Y., rules, Aug.-**7**; do. thro. an Am. forest, *Elec. Rev.* Aug. 2; do. Canada, Feb. 28-**3**; do. Germany, Jan. 31-**4**; magnetic, and Joseph Henry, Dickerson, addr. June 5-**6**; do. *Sci. Am. Sup.* June 26-**6**; message, cost, West. Uuion chart for 20 years, *Electric.* Jan.-**7**; military, during war, Treuenfield, *Elec. Rev.* Aug. 2-**3**; Irish's meth. *Elec. World*, Aug. 14, 21, Oct. 2-**6**; Ternant, *Sci. Am. Sup.* Feb. 7-**5**; see also TELEG., field; Morse, night circuit United Press, map, *Electric.* May-**5**.

" OCEAN CABLES (submarine), *Eng. News*, Nov. 17-**3**; *Iron Age*, Jan. 17-**4**; n. *Van Nost.* Apr.-**3**; trans-atlan., n. *Electric.* Feb.-**4**; stat. Sep.-**6**; Cuttriss ap. Dec.-**7**; marine, *Elec. Rev.* Apr. 26; messages, how received, June 7; of world, July 26-**3**; do. Mar. 19, May 7-**7**; Bishop's gutta percha wks. May 10; Atlan. exped. of 1857, Sep. 13; Atlan., Muirhead duplexing sys. Oct. 25, Nov. 8-**4**; Jan. 31-**5**; (2 miles under sea), rep. Dec. 17-**7**; Bennett-Mackay, track of, map, *Elec. World*, Feb. 16; Commercial Co.'s, May 3-**4**; cable working, Ebel, May 29-**6**; ap. *West. Electric.* Nov. 26-**7**; and torpedo lines, elec. grapnel for, Kingsford, *Sci. Am. Sup.* Mar. 29-**3**; working, Ebel, July 17-**6**; Sep. 3-**7**; eng. of, *Eng.* Dec. 14-**3**; June 13-**4**; do. life of, Oct. 9-**5**; resist. of faults in, Kennelly, Apr. 8-**7**; submar. property, English Soc. of, May 20-**7**; French, *The Eng.* Mar. 4-**7**. See also TELEGRAPHY, SUBMARINE.

" PHELP'S INDUCTION, *Ry. Gaz.* Feb. 20-**5**; rep. *Fran. Iust.* July-**6**; from moving trains, n. *Electric.* Mar.-**5**; phonoplex sys., Edison, *Ry. Gaz.* Oct. 22-**6**; do. do. or way-duplex, *Elec. World*, Apr. 17-**6**; do. *Elec. Rev.* Aug. 21-**6**.

TELEGRAPH, phonoplex sys. *Eng.* Oct. 22-6; pneu. sys., Willmot, Nov. 13-5; do. *The Eng.* Nov. 20-5; poles, and linemen, *Elec. Rev.* Sep. 4-6; do. large, N. Y. *Elec. World*, Oct. 3-5; do. iron, *Eng.* June 26-5; Postal Co. *Eng. News*, Mar. 24-3; do. *Iron Age*, Aug. 30-3; do. *Mech.* Sep. 1-3; do. *Elec. Rev.* Mar. 22, May 17-3; do. in England, Nov. 26-7; printing, Baillehache, Paris, *Elec. World*, Apr. 4-5; do. Brown's octuplex, July 16-7; quadruplex, Nicholson pat. *Electric.* Jan.-6; railroad, Phelp's, Oct.-3; do. Paine, Feb; do. locations, occupation of by, Mass. R. Coms. rep. Mar.-5; do. Supt.'s Assoc. pro. Aug.-7.

" SEXTUPLEX, Field, *Elec. World*, Nov. 27-6; do. *Sci. Am. Sup.* Feb. 5-7; signaling ap., St. Gothard Ry. *The Eng.* May 16-4; do. by sight, Max, Nov. 20, 20, 27-5; sketches sending by, *Elec. World*, May 1-6; Soemmering's, *Eng.* Nov. 16-3; sounders, Bright's, *Sci. Am. Sup.* Feb. 17-3; Speelier's time sys. *Elec. World*, Feb. 7-5; stat. of world, *Electric.* May-7; do. table, *Elec. Rev.* June 13-5; steno-mach. *Elec. World*, Apr. 24-6; synchronism, Houston, *Mech.* July-5; do. do. *Sci. Am. Sup.* Apr. 25-5; synchron.-multiplex, expt. do. *Elec. Rev.* Sep. 6, 6-4; do. *Elec. World*, Aug. 30-4; in practice, Houston, *Sci. Am. Sup.* Oct. 4, Nov. 1-4; Delaney's sys. Nov. 14-5; do. *Soc. Arts*, Mar. 13-4; telemeter sys., Clark's, *Elec. World*, Sep. 17-7; train, see R. TRAIN TELEGRAPHING; type printiug, Luchesini, *Eng.* May 30-4.

" WESTERN UNION CO., rep. *Ry. Gaz.* Oct. 12-3; stat., '66–'84, table, *Electric.* Nov.-4; rep. lines seized by, Aug, Oct, Nov.-5; stat. rep. Nov; earnings chart for 20 years, Dec.-6; message cost, chart for do. Jan; rep. year ending June 30, '87, Nov.-7; rep. *Elec. Rev.* Nov. 15-3; rep. Oct. 18-4; N. Y., with Lamson message carrier sys. June 25; N. Y. offices, Dec. 31-7; rep. *Elec. World*, Oct. 23-6.

" WIRES, comp., French, *Electric.* May-5; difficulties, pats., F. W. Jones, July-6; insulators, Gibbert, *Eng.* Apr. 1-7; speed of electricity in, expts. *Elec. Rev.* July 30-7; overhead, Maver, *Elec. World*, Nov. 22, Dec. 27-4; do. do. Jan. 3, 17; joints, Dec. 19-5; ærial, question, N. Y. Nov. 20-6; coeff. of self-induction in, Preece, Sep. 17-6; and teleph. conductors, sys. of, *Sci. Am. Sup.* Apr. 25-5.

" WIRES, UNDERGROUND, Jacques, *Eng. News*, Dec. 27-4; Boston, Mar. 27; problem, Oct. 9-6.

TELEG. WIRES, UNDERGROUND, in England, Fleetwood, *Ry. & Eng.* Aug.-7; elec. storms and, *Fran. Inst.* Nov.-5; Brook'ssys., F. L. Pope, *Electric.* Nov.-4; W. Thomson, rep. Feb.-5; Fleetwood, July-7; cables, in Germany, *Sci. Am. Sup.* Nov. 14-5; Jacques, *Soc. Arts*, Nov. 13-4; 1st. Am. *Eng.* Dec. 18-5.

" WRITING, *Elec. World*, Apr. 23-7; *The Eng.* Nov. 18-7.

TELEGRAPHIC ENG., in '82, *Eng.* Jan. 12-3.

TELEGRAPHY, prog. *Mech.* May 5-3; Preece, *Van Nost.* Sep.-3; *Electric.* Apr.-3; Edison, *Elec. World*, Jan. 24; old time, Haskins, Aug. 29-5; Preece, *Elec. Rev.* Mar. 29-3; 50 years, do. Aug. 20-7; do. do. *Sci. Am. Sup.* Aug. 20-7; optical, Sep. 12-26-5; *Eng.* Mar. 9-3; Preece, *The Eng.* Mar. 2-3; steno-, Phillip's, *Elec. Rev.* May 31-3; (stenographic printing), Cassagne's, *Eng.* Mar. 18-7; submarine, limits of, *Sci. Am. Sup.* Dec. 13-4; do. *Elec. Rev.* Nov. 29; under sea, Beane, Nov. 22, 29; ocean, Dec. 27-4; do. Maver, *Elec. World*, May 10, 17, June 14, July 12-4; condenser in, B. Thompson, Dec. 19-5. See also TELEG., OCEAN CABLES.

TELEPHONES, elec., S. P. Thompson, *Mech.* May 26-3; *Electric.* June-3; Taylor, May-5; profits, May-7; limits of action, *Elec. Rev.* Mar. 22; Bramwell, Mar. 29; peculiarities of, and users, May 10; Conv. pro. Oct. 25-3; and phonographic locmanand, H. C. Strong, June 5-6; limiting dist. of speech by, Preece, May 21; theory, July 9-7.

" TELEPHONIC induction and amplification of sounds, E. P. Thompson, *Elec. World*, Dec. 13-4; business, investigation, Forbes, May 2; notes, July 29; systems, Dolbear, Dec. 26-5; do. do. Jan. 2, 9; trans., receiving and reproducing speech, meth. by sensitive jets, June 12; in military telegraphy, Cardew, July 31-6; limiting dist. of speech by Preece, Apr. 16; Boursel magneto, of 1854, Barney, May 21-7.

" LECTURE, Reis, *Sci. Am. Sup.* Feb. 3-3; Munro's expts. July 26; Houston, Nov. 15-4; trans. of speech by discontin. elec. currents, Labye, May 23; commun. Aug. 1-15; Munro, Nov. 14-5; trans. and recording speech, Irish, Sep. 18-6; and protophone, A. G. Bell, Apr. 30-7.

" CURRENTS, ap. for studying, Cross, *Soc. Arts*, Apr. 9-5; *Eng.* Mar. 23; Labye, Oct. 26-3; Vienna exhib. Jan. 4-4; Antwerp exhib. Oct. 2-5; Mar. 26; early ap., Dolbear, Reis, Bell, Oct. 1-6; Swinton, May 27-7. See also under names, TELEPH., BELL, &c; also TELEPHONY; do. LONG DISTANCE.

TELEPHONES, Abakanonicz's sys. of commun, *Sci. Am. Sup.* Aug. 1-15; acoustic, Knudson, *Electric.* Nov.-**6**; Am. Bell Co. *Iron Age*, Apr. 9-**5**; do. rep. *Electric.* Apr, June-**5**,'86, May-**7**; do. do. *Elec. Rev.* Apr. 5-**3**, Apr. 3-**4**, Apr. 11-**5**, Apr. 3-**6**, Apr. 23-**7**; do. *Elec. World*, Apr. 4-**5**, Apr. 3-**6**; capital, Mar. 14-**5**; see also TELPH., BELL; Anders', *Sci. Am. Sup.* Nov. 7-**5**; ap., early, *Elec. World*, Sep. 4-**6**; do. S. P. Thompson's, *Sci. Am. Sup.* May 3-**4**; do. Apr. 3-**6**; do. for studying cnrrents, Cross, *Soc. Arts*, Apr. 9-**5**; do. Poole, *Eng.* June 4; do. early, Dolbear, Reis, Bell, Oct. 1-**6**; Bassano-Slater, *Elec. World*, Aug. 1-**5**; do. *Sci. Am. Sup.* July 25-**5**; in Belgium, *Elec. Rev.* Feb. 7-**4**.

" BELL sys. *Fran. Inst.* Jan.-**6**; hist. (monopoly), *Electric.* Jan.-**4**; Canadian case decis. Feb.-**5**; hearing before U. S. Secy. Interior, Dec.-**5**; May vs. Nat., N. Orleans decis. July; argument in govt. suit, Nov.-**6**; case, Indiana decis. *Elec. Rev.* Mar. 6; A. G. Bell, invs. of, expts. June 12-**6**; Judge Wallace's decis. *Elec. World*, Dec. 6-**4**; pat., null in Canada, Pope decis. Jan. 31; do. validity, Secy. Lamar, Jan. 23; microphonic figuring, Feb. 13; pats. May 29; N. Orleans decis. June 12-**6**; litigations, *Sci. Am. Sup.* Oct. 3-**5**; Bell case, *Eng.* Feb. 9-**3**; early ap. Oct. 1-**6**. See also TELEPH., AM. BELL CO.

" BLAKE TRANSMITTER, *Elec. Rev.* May 10-**3**; Bregnet's, *Sci. Am. Sup.* July 26-**4**; Bourseul's, of 1854, Nov. 27-**6**; Buffalo sys. *Elec. Rev.* Oct. 14-**4**; Button, *Elec. World*, Jan. 30, Feb. 6-**6**; cable sys., Cophenhagen, *Electric.* Apr.-**7**; cables, Lockwood, *Elec. World*, Sep. 24-**7**; call ap., Poole, *Elec. Rev.* June 26-**6**; do. Stabler's individual, *Elec. World*, Mar. 8-**4**; Canadian case decis. *Electric.* Feb.-**5**; *Elec. World*, Jan. 31-**6**; Chesapeake & Potomac Co.'s plant, *Elec. Rev.* Mar. 6-**4**; in China, Endicott, Sep. 3-**7**; circuits, Wiethbach, *West. Electric*, Nov. 26-**7**; Clay sys. *Elec. World*, July 12-**4**; companies, central, N. Y., rep. *Elec. Rev.* June 27; do. stat., U. S. July 11-**5**; do, Europe, *Eng.* Feb. 5-**6**; currents, measuring strength of, Cross, *Electric.* Nov.-**5**; *Eng.* Dec. 4-**5**; Jan. 1-**6**.

" DANN AND LAPP SYS. *Elec. World*, Dec. 18-**6**; Davies phonopore and teleg. *Eng.* July 16-**6**; Dolbear's, Gray's, *Fran. Inst.* Dec.-**4**; do. rep. Jan.-**5**; do. sys. Jan.-**6**; do. Houston, *Electric.* Feb.-**5**; do. static, *Sci. Am. Sup.* Oct. 6-**3**; do. Reis, Bell, early ap. *Eng.* Oct. 1-**6**.

TELEPHONES, Drawbaugh's, *Fran. Inst.* Apr, May-**5**; do. claim, F. L. Pope, *Electric.* Nov.-**4**; do. case, opinion, Wallace, Jan.-**5**; do. suit, *Elec. Rev.* Dec. 13-**4**; do. *Elec. World*, Apr. 12; do. claims, Oct. 4-**4**; do. *Sci. Am. Sup.* May 17-**4**; Ducousso's, *Elec. World*, June 7-**4**; duplex, Rosenburgh, *Electric.* May-**7**; dynamo,S. P. Thompson s, *Elec. Rev.* Feb. 5, 12-**7**; do. *Sci. Am. Sup.* Apr. 2-**7**; early, *Eng.* July 16-**6**; Edison's, *Fran. Inst.* Feb.-**5**; do. Jan.-**6**; do. invs., Houston, *Elec. World*, Feb. 21, 28, Mar. 7, 14-**5**; Elgin, mechan. *Elec. World*, Mar. 5-**7**; in England and France, *Elec. Rev.* Feb. 14-**5**; see also TELEPHONE, GRT. BRIT; do. Co.'s of, *Elec. World*, Aug. 15-**5**; Erie, rep. *Elec. Rev.* June 14-**4**; Europe, and teleg. sys. in, rep. Jan. 29-**7**; subscribers in, *Elec. World*, Dec. 11-**6**. See also TELEPH. STATISTICS; TELEPHONY, LONG DISTANCE.

" EXCHANGES, number in U. S., '83, *Elec. Rev.* May 24-**3**; Met. Co., N. Y. Feb. 7-**4**; do. Sep. 3-**7**; Nat. Assoc. pro. Sep. 12-**5**; do. 7th meeting, pro. *Electric.* Oct.-**5**; N. E., Boston, *Elec. Rev.* Sep. 26-**5**; Firman sys. Oct. 24-**5**; stat., Europe, Dec. 11-**6**; do. U. S. *Electric.* Nov.-**7**; Greenfield "listening" sys. *Elec. World*, Sep. 5; Exch. Assoc. pro. Sep. 12; mechan. sys. Dec. 26-**5**; Naglo's sys. Mar. 20; mechan., Shaver's, June 19; Kansas City, July 17; Nat. Exch. Assoc. pro. Sep. 18-**6**; do. Oct. 1; calling generators, Lockwood, Nov. 19-**7**. See also TELEPH. STATISTICS.

" EXPERIMENTS, thermal, Cross, *Electric.* Nov.-**5**; early, in telegraphing sound, Pickering, *Elec. Rev.* July 3-**6**; Paddock, Dec. 10-**7**; Munro's, *Eng.* Mar. 16-**3**; Freeman's, *Elec. World*, June 13-**5**; 1st., S. P. Thompson, *Elec. Rev.* July 12-**3**; do. *Sci. Am. Sup.* July 28-**3**; in France and England, *Elec. Rev.* Feb. 14-**5**; Gray's, *Fran. Inst.* Dec.-**4**; do. inventions, *Elec. Rev.* Dec. 13-**4**; do. cave at, *Elec. World*, June 5-**6**; Goloubitzky's, *Electric.* Jan.-**3**; do. *Sci. Am. Sup.* Feb. 10-**3**; in Grt. Brit. *Elec. Rev.* Sep. 17-**7**. See also TELEPH., England.

" HAMMER, Labye, *Elec. Rev.* Sep. 13, Nov. 1-**3**; Lochtlabye's, *Sci. Am. Sup.* Oct. 27-**3**; Herz, *Elec. Rev.* Apr. 9-**7**; hist., Falue, *Electric.* May-**3**; do. T. D. Lockwood. Apr.-**7**; Husband's, *Sci. Am. Snp.* Mar. 31-**3**; interrupted elec. currents, transmiss. of speech by, Kintner, *Electric.* Dec.-**7**; invention of, *Mech.* Sep. 29-**3**.

TELEPHONES, investigations, Cherrill, *Elec. Rev.* July16-7; Paddock, *Sci. Am. Sup.* Sep. 10-7; Irish's, Receiver, *Elec. World*, Sep. 12-5; do. meth. July 3-6; Italy, Co. stat., *Elec. Rev.* Aug. 16-3; do. Dec. 31-7; Krotophone, *Elec. World*, July 31-6, Labye, Belgium, *Mech.* Dec. 29-3; lines, Europe, *Electric.* Dec.-3; do. duplexing of, *Elec. World*, Oct. 23-6; in London, stat. *Elec. Rev.* Aug. 9-4; long distance, see TELEPHONY, LONG DISTANCE; McDonough's, *Fran. Inst.* Mar.-5; do. invs., Houston, *Electric.* Apr.-5; do. *Elec. World*, Nov. 1-4; mechanical, see TELEPH., Elgin; Mercadier, transmiss. *Sci. Am. Sup.* Jan. 9, Feb. 27-6; Meucci's claims, *Elec. World*, Nov. 28-5; do. *Sci. Am. Sup.* Dec. 19-5; Mexican Co. *Elec. Rev.* Apr. 5-3, Apr. 26-4, rep. Apr. 18-5.

" MICROPHONE, *Elec. Rev.* Nov. 15-4; reversible, *Elec. World*, Feb. 6-6; Mix-Genest, Oct. 1-7; Blyth, *Sci. Am. Sup.* Jan. 6, Mar. 31; micro-ap., D'Arsonval's, Feb. 3; Stroh, May 5; contacts, do. June 16-3; transmitter, Wreden's, Mar. 1-4; micro-ap. Sep. 26-5; Mix & Genest, *Sci. Am. Sup.* Oct. 15, Nov. 19-7; micro, button, Herz, *Eng.* May 6-7. See also ELEC. MICROPHONE.

" NAT. ASSOC. pro. *Elec. Rev.* Sep. 18; N. E. Teleph. & Teleg. Co. May 8-6; do. May 14-7; do. *Elec.. World*, May 15-6; Neumayer's, *Sci. Am. Sup.* Jan. 17-5; N. Y. & N. J. Co., exch. sys. *Elec. World*, Mar. 14-5; N. Y. & Phil. line, July 10-6; Oram time indic. *Elec. Rev.* May 24-4; do. *Sci. Am. Sup.* Feb. 6-6; Pan-Elec., hist. *Electric.* Apr, May-6; Paris, central office at, *Elec. Rev.* June 21, July 5, 12-3; do. Genl. Co., rep. *Eng.* June 5-5; Paris-Brussels line, *Elec. Rev.* July 30-7; patents, interference cases, *Electric.* Apr; do. Freeman, July-5. See also TELEPH., BELL, GRAY.

" PENDLETON'S AUT. RESPONDER, *Elec. World*, July 18-5; Phelps', Aug. 7-6; police sys. July 30-7; Pollard's, *Sci. Am. Sup.* June 2-3; portable, *Elec. World*, May 16-5; Pratt sys. *Elec. Rev.* Mar. 6-6; Providence Co. May 10-3; receivers, S. Thompson's, *Elec. World*, June 6; do. Irish's, Sep. 12-5; do. *Sci. Am. Sup.* Apr. 14-3; do. Thompson, *Eng.* Jan. 26-3.

" REIS', *Fran. Inst.* July, Nov.-5; Reis, inv. of, Jan; Jan, July-6; do. do. Houston, Jan, Oct.-7; *Electric.* May; transmittr, Nov.-3.

TELEPHONES, Reis question, *Electric.* July, Oct.-**7**; *Elec. Rev.* Nov. 8-**3**; *Sci. Am. Sup.* June 16; S. P. Thompson, Sep. 22-**3**; Oct. 24-**5**.

" SCOTLAND, in, *Elec. Rev.* May 28-**7**; do. *Eng.* Feb. 4, 18, Mar; 25, Apr. 29-**7**; signal, individual, Cary, *Elec. Rev.* May 17-**3**; in So. Australia, Sep. 27-**4**; So. N. England Co., rep. June 6-**5**, May 29-**6**.

TELEPHONE STAT. *Iron Age*, Jan. 10-**4**; U. S. *Electric.* Sep.-**6**; Europe, Feb; Exchange, U. S. Nov.-**7**; of world, *Elec. Rev.* Apr. 12-**3**; in London, Aug. 9; Oct. 11-**4**; Denmark, Apr. 10-**6**; European, June 5; exch., Europe, Dec. 11-**6**; do. *Elec. World*, Mar. 13-**6**; July 16-**7**; Denmark, *Eng.* Mar. 19-**6**.

" SUIT, U. S. Govt. *Elec. Rev.* Apr. 3-**6**; see also TELEPH., BELL; Sunset Co., map, May 2-**5**; Swiss sys. Oct. 4-**3**; switch sys., Gould, Jan. 29-**7**.

" SWITCHBOARDS, multiple, *Elec. Rev.* Nov. 1-**4**; McDaniel's, May 23-**5**; Shaver acous sys. June 19; Irish, June 31-**6**; Western Elec. Co.'s multiple, *Elec. World*, Oct. 18-**4**; "Law" multiple switch table for 4,000 wires, June 6-**5**; multiple sys., Carty, Sep. 19-**5**; multiple, for 1,000 subscribers, Sep. 4-**6**. See also ELEC. SWITCHBOARDS.

" TAYLOR'S elec. *Elec. World*, Apr. 25-**5**; Tedus, *Sci. Am. Sup.* Oct. 13-**3**; Texas, *Electric.* Oct.-**5**; time, transmiss. and telephones, Oram's indic. *Elec. Rev.* May 24-**4**; do. Phil. exhib. *Sci. Am. Sup.* Feb. 6-**6**; see also ELEC. TIME; tones and vibrations, Haskins, *Elec. Rev.* Oct. 10-**5**; transmitters, Blake, May 10-**3**; do. theory, Mercadier, Dec. 5, 26; Reis trans. Dec. 5-**5**; valve trans., S. P. Thompson's, *Elec. World*, May 23-**5**; make and break trans. June 11-**7**; do. Munro, *Sci. Am. Sup.* May 5-**3**; see also TELEPH., MICROPHONE; United Co. *Elec. Rev.* Aug. 16-**4**; valve, Thompson's, *Elec. World*, Apr. 10-**6**; Van Rysselberghe sys., Banneux, Feb. 9, 9, 16-**4**.

TELEPHONES, mechan. *Elec. World*, July 10-**6**; Phil. Elec. exhib. *Eng.* Oct. 10-**4**.

TELEPHONING, at sea, *Elec. Rev.* Dec. 27-**4**; faults, Seeley, Aug. 28-**6**; Boyer, Dec. 24-**7**; and teleg. simul. over same wire, *Elec, World*, May 23-**5**; commun. between ships at sea, Blake, Aug. 27; do. Fiske, Sep. 24-**7**; and teleg. simul. on same wires, *Sci. Am. Sup.* June 28-**4**.

TELEPHONING, possibilities of, commun. at sea, Bell, *Sci. Am. Sup.* Oct. 11; without wires, do. Nov. 1-4; do. Houston, Dec. 6-4. See also MARINE, SHIPS.

TELEPHONY, *Electric.* July-3; and induction coil, T. D. Lockwood, Apr.-June-6; Apr.-7; elec., Lorrain's imps. *Elec. Rev.* Jan. 22-7; Gillett's ap. *Elec. World*, Apr. 19; July 12; wireless, and radiaphony, Houston, Nov. 8-4; imps., Lockwood, May 22; domestic, Heller's, July 3-6; duplex, Roseburgh, Nov. 6-6; do. do. Mar. 5-7; in Scotland, *Eng.* Feb. 4, 18, Mar. 25, Apr. 29-7. See also TELEPH., IRISH'S.

" LONG DISTANCE, *Iron Age*, Oct. 7-6; Hall, *Electric.* Nov.-7; *Elec. Rev.* May 3-3; Am. Teleph. & Teleg. Co. sys. June 10, 17; Hibbard, Sep. 18-6; Apr. 30; distrib. Sep. 17; in Europe, Sep. 24; E. J. Hall, Oct. 1-7; imps., long dist. lines, Lockwood, *Elec. World*, May 22-6; *Eng.* May 28-6.

TELESCOPE, I. O. Baker, *Eng. News*, Aug. 21-6; eye-pieces, Hiscox, *Sci. Am. Sup.* Aug. 25-3; objectives and mirrors, Grubb, July 3, 10, Oct. 23; astronom., hist. of discov., Lagrange, Aug. 28-6; Hiscox, Feb. 19, 26; lenses manuf. Mar. 5, 11-7; equatorial, Grubb, constructor, Mancnester exhib. *Eng.* Dec. 16, 30-7; prog. in size, *The Eng.* Mar. 21-4; and observatory, Mt. Hamilton, Cal. July 9-6.

TELPHERAGE, elec. hauling by, *Iron Age*, Nov. 12-5; transmiss. of power, and telpher locom., Jenkin sys. *Mech.* Sep.-4; *Ry. Gaz.* Nov. 13-5; Jenkin sys. *Van Nost.* Dec.-3; do. Sep.-4; do. May-5; telpher line at Glynde, England, *Electric.* Dec.-5; power transmiss. by, May-6; Jenkin, *Elec. Rev.* Dec. 6-3; "Series" sys. *Elec. World*, May 10-4; Van Depoele, sys. Oct. 9-6; line at Glynde, July 16-7; do. *Sci. Am. Sup.* Jan. 9-6; F. Jenkin, Dec. 29-3; do. *Elec. Rev.* Jan. 19-4; do. *Eng.* Apr. 6-3; telpher locom., Easton, Shrewsbury Show, July 18-4; *The Eng.* June 6-4; line at Glynde, Oct. 23-5.

TEMPERATURES, UNDERGROUND. See EARTH TEMPS.

TENNESSEE manufs. and minerals, U. S. con. rep. *The Eng.* July 8-7.

TERRA COTTA manuf. *Sci.Am.Sup.* Jan. 22-7.

TESTING MACHINES, for materials, ap. for, U. S. *Mech.* Feb. 3-5; do. Henning, Aug. 5-5; do. *Am. Eng.* June 12-26-5; Abbott, Mar. 15-4; do. *Van Nost.* Mar.-June-4; Emery's, Watertown rep. *Eng. News*, Jan. 27-3; do. *Iron Age*, Nov. 29, Dec. 6-3; do. Jan. 24-4.

TESTING MACHINES, Emery's, tests, *Iron Age*, Oct. 2-4; do. *Mech.* Nov. 3,10, wk. with, Dec. 1-3; do. *Sci.Am.Sup.* July 3-6; do. *Eng.* Aug. 17-3; Fairbank's 200,000 lbs. *Iron Age*, May 3-3; *Mech.* May 12-3; 200-ton, *Sci. Am. Sup.* Feb. 9-4; King's do. Coll. *The Eng.* Oct. 5, 12-3; laboratory, English, *Sci. Am Sup.* Sep. 6-4; Leoben, Sch. of Mines, *Eng.* Apr. 13-3; Olsen's, *Fran. Inst.* Jan.-3; specimens, J. B. Johnson, *Ry. Gaz.* June 17-7; Riehle, *Iron Age*, Feb. 22-3; do. *Mech.* Mar. 3-3; test pieces for bars and plates, Hackney, *Eng. News*, Mar. 1-4; 600-ton, Union Bridge Co., Athens, Pa. *Eng.* May 6-7; do. do. MacDonald, *Ry. & Eng.* Feb.-7; 100-ton, Werder, *Iron Age*, July 5-3; do. *Eng.* June 8-3; Wicksteed's, *Sci. Am. Sup.* Apr. 24-6; do. *The Eng.* May 8-5.

TEXTILE MACH., exhib., Islington, *Sci. Am. Sup.* Oct. 25-4; do. at Manchester, Oct. 8-7; do. Agric. Hall, *The Eng.* Aug. 29-4.

THEATRE, Royal Monnaie, Brussels, *San. Eng.* Oct. 15-5; Paris ordinances, Sep. 24-7; stages, movable, Madison Sq. theatre, N. Y. *Sci. Am. Sup.* Aug. 30-4; Alhambra, London, *Eng.* Mar. 14, June 20-4; Aquatic Circus, Paris, Edoux, eng. *The Eng.* Mar. 19-6.

THERMOMETERS, color, *Mech.* Jan. 20-3; hist. May 3-4; Green, calibration, Hansen's meth., Brown, *Van Nost.* July-3; rep. *Fran. Inst.* Mar.-6; Guichard's, *Sci. Am. Sup.* Apr. 25-5; for high temps., Armstrong, July 10; and baroms., registering, Oct. 9-6; correcting, *Locom.* Aug.-4.

THOMAS, SIDNEY G. *The Eng.* Feb. 13-5.

THURSTON, ROBERT H., Suplee, *Mech.* Mar.-7.

TIDE gauge, and reservoir, self-recording, Wm. Thomson, *Eng. News*, May 19-3; Roberts', *Sci. Am. Sup.* Dec. 12-5; Fuess, Sep. 24-7; Liege's, *The Eng.* Oct. 30-5; ht. registering mach., elec., Mangraph, *Sci. Am. Sup.* June 28-4; motor, Harding, Inv's exhib. *Eng.* May 1-5; tidal power, for water raising, *San. Eng.* May 8-4; do. n. *Van Nost.* Dec.-5.

TIDES, theory. Preandean, *Eng. News*, Dec. 25-6; and tidal scour, Boult, *Van Nost.* Feb.-3; theory and predictions, *Fran. Inst.* Mar, Oct.-5; util. *Electric.* Jan.-3; tidal action, Snowden, *The Eng.* Jan. 23-5.

TILE MAKING MACHS., at Blois, Joly, *Sci. Am. Sup.* Nov. 22-4.

TIME, *Van Nost.* Mar.-4; prime meridian, Mar; universal, or world, May-6; standard, *Ry. Gaz.* Apr. 20, Nov. 16-3; do. conv. rep. Apr. 18-4; do. *Locom.* Oct.-3; do. map, *Sci. Am. Sup.* Mar. 15-4; observations, Alexander; July 28-3; keeping, reformation of, W. F. Allen, Dec. 20-4; the worlds first meridian, R. A. Proctor, Jan. 24-5; transmitter, Oram's, Feb. 6-6; regulator, Am., do. *Eng.* Apr. 17; registers, watchmen's, Oct. 28-5. See also WATCHMANS.

TINNERS MACH., Peck, *Iron Age*, Apr. 28-7.

TIN, can mach., Norton's, *Sci. Am. Sup.* Aug. 18; mines of Perak, Malay, Aug. 25-3; plate, indus., Brit. *Iron Age*, May 17; do. manuf., Trubshaw, June 7-3; do. do. Stercken, Nov. 17-7; do. do. Flowers, *The Eng.* May 14-6. See also METALS, TIN.

TOBOGGAN SLIDES, *Sci. Am. Sup.* Nov. 6-6.

TODHUNTER, ISAAC, *The Eng.* Mar. 7-4.

TOOLS, of pyramid builders, *Eng. News*, July 28-3; do. *Eng.* June 22-4; and implements, prehistoric, in Am. *Iron Age*, Apr. 10-4; grinding mach., Sellers, *Ry. & Eng.* July-7. See also AGRIC. IMPLEMENTS; MACHINE TOOLS.

TORPEDOES, *Eng.* Dec. 3, 17-6. See also EXPLOSIVES; HARBOR ENG; MARINE TORPEDO BOATS.

TOWERS; see also CHIMNEYS, TALL; Boudais, 1,000-ft., Paris, *Eng. News*, Jan. 10-5; *Iron Age*, June 18-5; *Eng.* Feb. 27-5; Eiffel, 1,000-ft., Paris, *Eng. News*, n. Sep. 17, Oct. 1; foundations, Apr. 23-7; do. *Sci. Am. Sup.* Aug. 20; Oct. 22-7; Feb. 7-5; *Eng.* Dec. 19-4; Apr. 29-7; and Jubilee, *The Eng.* Mar. 11-7.

" HEIGHTS of, and spires, etc. of world, *Eng. News*, Sep. 1, Nov. 17-3; *Iron Age*, Sep. 6-3; *Am. Eng.* Feb. 27-5; *Locom.* Jan.-5; Pub. Bu.'s, Phil., hoisting ap. *Eng. News*, July 2, 9-7; St. Marks campanile, Venice, foundations of, Sep. 5-5; St. Patrick's Cath., N. Y., erection of, *San Eng.* Dec. 4-18-6; Trevithick, proposed, *Eng. News*, Oct. 9-6; Victoria Jubilee, London, *Sci. Am. Sup.* Jan. 22-7; and Eiffel, *The Eng.* Mar. 11-7.

" WASHINGTON MONUMENT, and others, *Eng. News*, Dec. 15-3; Dec. 27-4; Mar. 14, 28-5; *Iron Age*, July 31-4; and others, *Am. Eng.* Feb. 27-5; *San Eng.* Mar. 5-5; *Sci. Am. Sup.* Jan. 10; completion of, Feb. 14; Mar. 7-5; *Am. Arch.*

TRAUTWINE, JOHN C. *Eng. News*, Sep. 22-3; *Ry. Gaz.* Oct. 5-3.

TRAVELS, exploration and outfit for, Fielding, *Van Nost.* May-**5**.

TREES, big, of Cal. *Sci. Am. Sup.* Aug. 11-**3**.

TREVITHICK, RICHARD, *Sci. Am. Sup.* Feb. 10, Apr. 14-**3**; *Eng*; *The Eng.* Feb. 16-**3**.

TUBES, corrug. tubing, Wainwright Mfg. Co. *Iron Age*, Jan. 3-**6**; seamless, from solid blanks, *Ry. Gaz.* Oct. 14-**7**; do. *Am. Mach*; do. *The Eng.* Nov. 11-**7**; do. copper, *Eng.* Sep. 17-**6**; beader, Wicksteed's, *The Eng.* Oct. 2-**5**; metal, mach., Robertson, Nov. 5-**6**.

TUNNELING, alignment, Stearns, *Eng. News*, Aug. 16-**4**; arches, brick bond for, Schenck, *Ry. Gaz.* Apr. 23-**6**; boring with compressed water, *Iron Age*, Oct. 30-**4**; centering, iron, *Ry. Gaz*, Oct. 14-**7**; construct., econom., Siegler, *Eng. News*, Dec. 25-**6**; do. rapid, meth. of Bridel, *Van Nost.* Feb.-**4**; do. with 3 separate openings, Crampton, *The Eng.* Oct. 19-**3**; drills, mach. in, Lorenz, *Eng. News*, Apr. 30-**7**; dump car, end, Apr. 21-**3**; fast, Mar. 5-**7**; do. *Iron Age*, Apr. 1-**6**; do. Feb. 24-**7**; do. *Mech.* Dec. 8-**3**; do. *Ry. Gaz.* Feb. 2-**3**; hoisting cage, *Eng. News*, Mar. 31-**3**; hydr. mach., Crampton's, *Sci. Am. Sup.* Apr. 7-**3**; thro. loose material, Bourdiol sys. *Eng. News*, June 18; in Montana, Aug. 27-**7**; Mt. Blanc, Grt. St. Bernard, May 5-**3**; Red Point, Cal. *Ry. Gaz.* Apr. 15-**7**; speed of, n. *Mech.* July-**6**; in Col., cost, *Eng. News*, Apr. 2-**7**; submarine, Hall's sys. May 23-**5**; do. do. *Iron Age*, Apr. 16-**5**; subaqueous, Hall's device, *Ry. Gaz.* Apr. 17-**5**. See also names under TUNNELS.

TUNNELS, of ancients, *Iron Age*, Mar. 25-**6**; carb. oxide in, *Eng.* Feb. 11-**7**; submarine, Crosby, *Soc. Arts*, Jan. 25-**3**; Allegheny Mt. *Eng. News*, Nov. 21, 28, Dec. 12-**5**; Alpine and temps. in, n. *Van Nost.* May-**6**.

" ARLBERG, Alpine, Aus. *Eng. News*, Nov. 17, Dec. 15-**3**; drills, Specht, Jan. 19, 26; transport. in, do. Aug. 2; chains in, do. Aug. 23; ventil. in, Dec. 6-**4**; *Iron Age*, May 31, Dec. 6-**3**; locoms. *Am. Eng.* Sep. 17-**5**; *Ry. Gaz.* Oct. 24-**4**; *Sci. Am. Sup.* Mar. 1, May 24-**4**; May 16-**5**; *Eng.* Nov. 23-**3**, Mar. 21-**4**; air compressors at, Apr. 10-**5**.

" BOSTON, st. Ry., proposed, *Eng. News*, May 28-**7**; do. sewerage wks. *San. Eng.* Mar. 13-**4**; Channel, France & England, Calais & Dover, excav. ap. *Eng. News*, May 26; July 28-**3**; *Sci. Am. Sup.* Feb. 17-**3**.

TUNNELS, Crampton's hydr. sys. for excav. *Eng.* Jan. 12; scheme, July 6, 13-3; *The Eng.* Apr.6, 27, May 4, boring mach. June 15-3; Chicago lake, *Eng. News*, Oct. 29-7; *Eng. & Bu. Rec.* Oct. 29-7; Croton aqued., N. Y., fast wk. *Iron Age*, Apr. 1-6; Feb. 24-7; *San. Eng.* May 21-5; ventil. aud lighting, rep. Jan. 8-7; headings meeting, *Eng. & Bu. Rec.* Nov. 26-7; *Ry. Gaz.* Apr. 30-6; fast tunneling, Feb. 18; July 29-7; *Sci. Am. Sup.* Sep. 11-6; Detroit r., Hall open caisson sys. *Eng. News*, Mar. 26-7; Festiniog & Bettus Ry. *Eng.* Apr. 13-3; do. W. Smith, *The Eng.* Apr. 13-3; Greek, 6th cent. B. C., Merriam, *Eng. News*, May 9-5; Hoosac, Jan. 30-6; do. *Eng.* Feb. 4, May 14; do. centering in, July 23, Oct. 1-7; Hudson r. *Eng. News*, May 8-6; do. *Eng.* June 12-5; locoms. Feb. 16-3; London & Southwark subway, under Thames r. *Eng. News*, Apr. 2-7; do. *Sci. Am. Sup.* Dec. 31-7; long, construct. of, Bridel, *Eng. News*, June 30-3; do. ventil. and diam. drills, May 3-4; longest, Jan. 29-7; do. (in Russia), *Iron Age*, Nov. 24-7; do. in world, *Locom.* Feb.-7; Marot, *Sci. Am. Sup.* Feb. 14-5.

" MERSEY, & RY., Liverpool, *Eng. News*, Oct. 13-3; Feb. 16-4; opening, Apr. 4-5; *Iron Age*, Mar. 12-5; Feb. 11-6; n. *Am. Eng.* Mar. 13-5; Fox, *San. Eng.* Oct. 7-30-6; *Ry. Gaz.* Apr. 16-6; *Sci. Am. Sup.* May 12-3; Mar. 8-4; Feb. 27, Apr. 10-6; July 30-7; *Eng.* Sep. 28, Nov. 2-3; Jan. 22-6; Reade, *The Eng.* Aug. 14-5; opening, Jan. 22-6.

" N. J. & CEN. CO.'S, *Eng. News*, Dec. 15-3; Northumb. Straits, tub. subway under, New Brunswick to Prince Edward Is. *San. Eng.* July 23-7; old, *Eng. News*, Aug. 2; Pfaffensprung, St. Gothard Ry., Brandt rock drill in, Feb. 9-4; Phœnixville, Penn. (Schuyl. Val. R.) Oct. 3-5; sections, Mar. 5-7; *Am. Eng.* Sep. 17-5; Pittsburg, wk. at, *Ry. Gaz.* Aug. 24-3; Severn, & Ry. *Eng. News*, Apr. 17-6; Aug. 13-7; *Mech.* Nov.-5; *San. Eng.* Sep. 30-6; Hawkshaw, *Sci. Am. Sup.* Oct. 18-4; May 1-6; and Mersey, July 30-7; *Eng.* Aug. 29-4; Aug. 27-6; Sep. 9-7; & Ry., Hawkshaw, *The Eng.* Sep. 26, 26-4.

" SIMPLON, Switz. *Eng. News*, June 2-3; Mar. 8-4; proposed, July 2-7; *Ry. Gaz.* May 20-7; n. *Van Nost.* June-6; snow, Can. Pac. R. *Eng. News*, Sep. 4-6; So. Peun. R. Sep. 1-3; Nov. 14, Dec. 19-5; cost of, prog. Jan. 2; St. Clair, Penn. (Schuyl. Val. R.), Oct. 30-6; Aug. 20-7.

TUNNELS, St. Gothard, Switz., circular, etc. *Eng. News*, Nov. 10-**3**; contract, July 11-**5**; *Ry. Gaz.* Jan. 25-**4**; *Eng.* Feb. 9, 16-**3**; compressors and drills, Wendelstein, *The Eng.* Feb. 9-**3**; ventil. May 4, 25-**3**; Stampede Pass, No. Pac. R., and switch-back, *Ry. Gaz.* Dec. 23-**7**; at Stockholm, for foot pass. *San. Eng.* May 6-**6**; *Sci. Am. Sup.* May 22-**6**; *The Eng.* Apr. 9, 9-**6**; sub-aqueous, *Ry. Gaz.* Feb. 25-**7**.

" TEMPERATURES in great Alpine, *Iron Age*, Feb. 11-**6**; Thames r., London, new high level, proposed, *Sci. Am. Sup.* June 4-**7**; do. Maynard, *Eng.* Aug. 14-**5**; three-way, Crampton, *Eng. News*, Nov. 24-**3**; Vosburg, Lehigh Val. R. *Eng. News*, July 26-**4**; *Ry. Gaz.* Feb. 22-**4**; Penn. & N. Y. Oct. 1, 8; brick tests, Oct. 15-**6**; Washington aqued., and air compress. plant, *Eng. News*, Feb. 16-**4**; map, *Sci. Am. Sup.* Mar. 8-**4**; Weehawken, N. Y. W. Sh. & B. *Ry. Gaz.* Mar. 2-**3**; wicker, Mont Cenis, Aug. 19-**7**; Yanagase-Yama, Japan, *Ry. & Eng*, Dec.-**7**.

TURBINE GOVERNORS, Hett's, *Mech.* Dec.-**5**; do. *The Eng.* June 26-**5**; Girard, *Eng.* Apr. 17-**5**.

TURBINES, Keiser, *Iron Age*, May 15-**4**; and water wheels, Turnbull, *Mech.* Mar. 31; S.W. Robinson, Oct. 27; Thurston, Dec. 22-**3**; Keiser, May 3-**4**; turb. water wheel, Humphrey, Tremont mills, Lowell, expts. Jan.-**5**; tests, in U. S., Thurston, sup. June-**7**.

" AIR COMPRESSOR for rock drills and tunnel ventil., B. F. Wright, *Am. Eng.* Apr. 18-**4**; Girard, May 8-**5**; turb. water wheel, error in, *Fran. Inst.* Aug; centrif; force in, Sep; theory of, Dec.-**3**; do. Jan, May. June; discharge, July; Geyelin, test, Aug.-**4**; Nov, Dec.-**6**; momentum, Wood, Jan; Church, Apr, May; discharge; n., Frizell, July-**7**.

" WATER WHEELS, for small industries, Bell, *Sci. Am. Sup.* Apr. 14; early hist. Dec. 8-**3**; and screw propellers, flow of water thro., Rigg, Oct 25-**4**; and reaction wheels, Donaldson, Feb. 20-**6**; inventor of, G. Walker, May 7-**7**; Girard, and Koster, *Eng.* Mar. 16-**3**; do. for high falls, July 11; flow of water thro. Sep. 19-**4**; Girard, and gov. Apr. 17-**5**.

" WATER WHEELS, and testing ap., Turnbull, *The Eng.* Feb. 16, Mar. 2; Portrush tramway, Sep. 28; theory, error in, Frizell, Oct. 26; and air compressor, Yanagase tunnel, Japan, Dec. 21-**3**.

TURBINE WATER WHEELS, theory, Donaldson, *The Eng.* June 6, 20; flow water thro., and screw propellers, Rigg, Sep. 12; Girard, Sep. 12-4; H. P. of, R. H. Smith, Sep. 4, 25, Oct. 30, Donaldson, n. Oct.30-5; and reaction wheels, Donaldson, Jan. 8; in Walcot flour mill, Nell, eng. Dec. 10-6; at Manchester exhib. June 17; vert., Terni Steel wks., Rieter, eng., Sep. 23, 23-7.

TWICHELL, GINERY, *Ry. Gaz.* July 27-3.

TYNDALL, JOHN, *Electric.* Aug.-7.

TYPE, COMPOSING MACH, Lagerman's, *Sci. Am. Sup.* July 4-5; do. and distrib. mach., Fischer. *Eng.* July 25, Aug. 1-4; do. do. Thome, July 1-7; setting mach., McMillan, *Am. Eng.* Oct. 5-7.

TYPE WRITERS, Crandall, *Iron Age*, Sep. 17-5; Hall, *Fran. Inst.* May-3; do. *Eng.* Jan. 5-3; Columbia, Inv's exhib. May 1-5; writers, Huling, *Sci. Am. Sup.* Jan. 1-15-7.

UNITED STATES. See also under different subjects and names of countries; indus. prog. *Eng. News*, Mar. 31; names of states, Oct. 6-3; mail, losses of, Dec. 20-4; Sec. War, rep. Dec. 19-5; govt. scientific bureaus, Feb. 13-6; Govt. and pub. wks. Oct. 8-7; do. *Lippincotts*; census stat. *Iron Age*, Mar. 1; tariff bill, Morrill, Mar. 8; trade, So. Am., since '76, May 17; war, mortality stat. June 28; mineral products, Aug. 9; exports of stoves, Aug. 16; industries of chief cities, Aug. 23; foreign commerce, Aug, 30, foreign trade, for year, Sep. 6; do. in coal and metals, Dec. 6-3; tariff, Hewitt, Jan. 3; do. hist. Feb. 14; trade with So. Am. Feb. 7; commercial stat., '84, Oct. 16; exports, foreign, Nov. 6-4.

" IMPORTS and exports, '84, *Iron Age*, Apr. 23; mineral production, June 25; imports, '84 and '85, Aug. 13; do., class. Sep. 24; foreign commerce, Nov. 26; exports, Dec. 10-5; commerce in '85, Jan. 21; immigration in '84 and '85, Jan. 28; exports, '85, foreign markets, Feb. 4; do. domestic, Oct. 7; imports, and duties, Feb. 25, Sep. 30; do. from Grt. Brit. June 24; trade with foreign countries, Mar. 4-6; imports and exports, '86, Feb. 10; naval vessels, Apr. 21; tariff, Canadian, May 19, 26; immigration, June 2; Govt. outlook, Mav. bnk. manual, July 21; trade, So. Am. Oct. 20; coinage, '86-7, Nov. 17; imports, iron and steel, Dec. 29-7.

" IMMIGRATION, *Ry. Gaz.* Sep. 7-3; do. and pop. Feb. 8; exports, May 23-4.

UNITED STATES, exports, grain, *Ry. Gaz.* July 24; do. and imports, Aug. 14-**5**; do. grain, Jan. 22; pop. growth and food produc. July 9; exports, food, dec. of, Oct. 8-**6**; do. Oct. 21-**7**; pub. wks. policy, Cooley, *Van Nost.* Apr; navy, Fiske, May; do. Simpson, May-**6**; mineral products of, *Fran. Inst.* Sep.-**3**; navy, coast survey and hydrog. wk. May-**6**; growth since 1800, *Elec. Rev.* Oct. 18-**3**; scientific service, *Sci. Am. Sup.* Mar. 17-**3**; Grand Canon, Col., view, Jan. 19-**4**; as it was in 1780, as it is in 1880 and what it will be in 1980, Hickman, May 16-**5**; commerce, foreign, since 1861, *Locom.* Apr.-**7**; tariff bill, *Eng.* Mar. 30-**3**; Yellowstone Nat. Park, Sep. 23, 30-**7**.

URE, JOHN FRANCIS, *Eng.* May 25-**3**.

URUGUAY, U. S. trade with, *Iron Age*, Oct. 22-**5**; recent developments, May 6-**6**.

VACUUM gauge testing air pump, *Locom*, Sep.-**7**; pan and evaporator, Frenzel's, *Eng.* Dec. 23-**7**; do. sugar, great, San Fran. *The Eng.* 2-**5**; pumps, Neveux's, *Sci. Am. Sup.* June 21-**4**.

VALVE, Mason reducing, *Am. Eng.* Nov. 3; do. *The Eng.* Dec-31-**6**; Leng's lever and cam gate, Dec. 22-**6**; straightway, *San. Eng.* June 11-**5**; Messenger's full way, *Sci. Am. Sup.* Aug. 1-**5**. See also STEAM VALVE.

VAN DEPOELE, CHAS. *St. Ry. Gaz.* Aug.-**7**.

" NOSTRAND, DAVID, por. *Van Nost.* Dec.-**6**. See also NOSTRAND.

VANDERBILT, WM. H. *Ry. Gaz.* Dec. 11, 18-**5**.

VAPOR ENGS., effic. of fluid in, Gautt, *Van Nost.* Nov.-**4**.

VARLEY, CROMWELL F. *The Eng.* Sep. 7-**3**.

VASELINE, petreoline-neutraline manuf. *Sci. Am. Sup.* Apr. 18-**5**.

VEHICLES of locomotion, curious, *Sci. Am. Sup.* Apr. 14-**3**.

VELOCITIES, different, in metres per sec., table, *The Eng.* Nov. 2-**3**.

VENEER CUTTER, stm., Crane, *Mech.* sup. June-**7**.

VENEZUELA, trade, *Iron Age*, July 16; Dec. 17-**5**.

VENICE, foundations of, *Eng. News*, Sep. 25-**6**.

VENTILATION, Greenleaf, *Van Nost.* Nov.-**5**; May-**6**; *Nature.* See also HEATING AND VENTIL; STM. HEATING.

VENTRILOQUISM, *Sci. Am. Sup.* Aug. 21-**6**.

VICTORIA, QUEEN, por. *Sci. Am. Sup.* June 25-**7**.

VIRGINIA, SO. W., Hogg, *Sci. Am. Sup.* Jan. 6-**3**.

VISE, grip, *Iron Age*, Oct. 16-4.

VITAL STATISTICS, in large cities, *Iron Age*, July 5-3; Billings, *San. Eng.* Nov. 22, Dec. 6-3; do. Dec. 4-4; mortality stat., table, Nov. 22 &c.-3; U. S. July 1- death rates in, July 15; of Glasgow, J. B. Russell, Sep. 16-6.

VOTING MACH., Daville's, *Sci. Am. Sup.* May 3-4.

WAGES, in Grt. Brit. *San Eng.* Aug. 13-7; *The Eng.* May 27-7. See also LABOR.

WALKING, length of step, *Iron Age*, July 16-5.

WALSH, JULIUS S., por. *St. Ry. Gaz.* Feb—6.

WARPING MACH. *Sci. Am. Sup.* Apr. 23-7.

WASHINGTON, D. C. *Eng.* Sep. 2, 9-7; munic. eng. *Eng. News*, Aug. 28-6. See also ENG. MUNIC.

WASTE, util. of, Simmonds, *Sci. Am. Sup.* Feb. 3, 10; cleaning mach. Aug. 4-3.

WATCH MAKING, Swiss, stat. *Iron Age*, July 31-4; Am. Aug. 5-6; do. Waldo, *Van Nost.* July-6; watchmakers lathes, Rose, *Mech.* Aug. 4-3; watches, shield, anti-magnetic, Giles, *Elec. Rev.* May 9-5; Waltham, *Eng.* July 3, 17, 24-5; stop and chronographs, *The Eng.* Apr. 8-7.

WATCHMENS, telltale, elec., Fletcher's, *Elec. World*, May 3; time detector, Dec. 13-4.

WATER, aeration of, C. B. Brush, *San. Eng.* July 23-5; anal., Cory, rep. May 3-3; do. Wanklyn's meth. *Eng. News*, June 4-7; do. Dupre, *The Eng.* Nov. 20-5; Chicago, *San. Eng.* Mar. 5-7; do. anal. *Am. Eng.* Aug. 20-5; collection, storage, purchase and exam. *Eng. News*, June 12-6; Co.'s, Southwark and Vauxhall, *Sci. Am. Sup.* Nov. 22-4; do. London, *The Eng.* Aug. 1; at Health exhib. Oct. 17-4; consump., German rules, *Eng. News*, Oct. 31-5; do. es. of, *San Eng.* June 4-5.

" DOMESTIC, distil. ap. *San Eng.* Dec. 25; Creque sys. of defecating, storing, circul., and employing for domestic purposes, Creque, Nov. 27-6; do. do. *Soc. Arts*, May 13-6.

" DRINKING, zinc in, *Iron Age*, Apr. 30; sea, making potable, June 4-5; Chicago, anal. *Am. Eng.* Aug. 20-5; san. exam. of, Angell, *Sci. Am. Sup.* Nov. 8-4; purific. by alum, Austen, May 30-5; potable, micro-organisms of, Leone, Jan. 16-6; and typhoid fever, relation between, Benjamin, June 11-7. See also MARINE, SEA WATER.

" EVAP. expts., Fitzgerald, *Sci. Am. Sup.* June 5-6; exam. for micro-organisms, *Eng. News*, Mar. 6-6; do., Bischof, *San. Eng.* Dec. 31-5.

WATER FILTERS, filtration, Turner, *Eng. News*, Apr. 18-**5**; Warren, Nov. 19-**7**; filtration, natural, Pearson's, *San. Eng.* July 23; do. or subsidence, J. D. Cook, July 30; and purifier, Blessing's, July 23-**7**; Piefke's rapid, *Sci. Am. Sup.* June 21; Hyatt, June 21; filtering presses, pneu. July 19-**4**; Chamberland's, Oct. 3-**5**; high press. Dec. 4-**6**; micro-membrane, Nichols, *Soc. Arts*, May 13-**6**; Thames, *Eng.* Jan. 12-**3**; do. Apr. 18-**4**; do. *The Eng.* Sep. 21-**3**; do. Pulsom. Co. July 25-**4**; filter presses, Johnson's, June 6, 13-**4**; Piefke's, *Eng.* Mar. 23-**3**; filtration, Gerson sys. Nov. 18-**7**.

" GROUND, influence on health, *Eng. News*, Oct. 23-**6**; hammer, or hydr. ram, Baillairge, *Am. Eng.* June 6, 13-**4**; hardness of, test, Hardy, *Eng. News*, June 11-**7**; heating, flame contact in, Fletcher, *Van Nost.* Aug.-**6**; and ice, properties, Petterson, *Sci. Am. Sup.* Oct. 13-**3**; leak detector, hydrophone, A. Paris, *Eng.* July 29-**7**; level indic., elec., Parenthou's, *Sci. Am. Sup.* Nov. 21-**5**; lifts, East Indian, *Eng. News*, Sep. 10-**7**; lifting, new meth. of, W. Siemens, *Am. Eng.* Oct. 29-**5**; locom., Wernigh, *Sci. Am. Sup.* June 25-**7**.

WATER MAINS, iron, corrosion of, *Iron Age*, June 11; throttle valve, Nov. 5-**5**; do. self-acting, Scotch, *Mech.* Dec.-**5**; flow stopping by anchor ice, Francis, *Am. Eng.* July 13, 20-**7**; raising large, Boston, *San. Eng.* Feb. 19-**7**; draining and filling, S. B. Russell, *Eng. & Bu. Rec.* Dec. 24-**7**; corrosion, exterior, Borden and Nichols, *Van Nost.* Feb.-**6**.

" MEASURING, by metric sys. *Eng. News*, Dec. 22-**3**; and flow of, in ditches, Bowie, *Van Nost.* Jan; do. Browne, May; do. Pierce, June; do. Emery, n. June-**5**; flow of, expt. comparison of different meths., Swain, *Soc. Arts*, Jan. 27; accurate, elec. ap. for, Lowe, Oct. 27-**7**.

" METERS, Tremont, Boston, *Eng. News*, Sep. 15, 22-**3**; tests, Alsace, Oct. 31-**5**; Apr. 17; Foote, Nov. 13; Tilden, Dec. 25-**6**; Thomson, Dec. 31-**7**; tilting,. for expts., Hoadley, *San. Eng.* Jan. 17-**4**; do. do. *Fran. Inst.* Apr.-**4**; do. do. *Mech.* Nov. 17-**3**; large, n. Nov.-**5**; Tilden, *San. Eng.* Feb. 5-**7**; Venturi, Herschel, *Eng. & Bu. Rec.* Dec. 24-**7**; tests, Worthington, Kennedy, Siemens & Hess, Browne, *Van Nost.* July; Frazer, Andre, Aug.-**5**; Helbing's liquid, *Sci. Am. Sup.* Feb. 10-**3**; Dreyer's, May 3-**4**; Frost's, Siemen's, Kennedy's, Sep. 27-**4**; Schmidt's, *Eng.* May 11-**3**; tests, rep. May 30-**4**; Deacon, waste-, sys. Nov. 20-**5**.

WATER METERS, Frost, *Eng.* Sep. 16; siphon, Dec. 2-7; Melling's, *The Eng.* Oct. 23-5; Cowan's siphon, Sep. 30; G. Kent's, Dec. 2-7.

" MICROBES, *Sci. Am. Sup.* July 19, 26-4; micro-organisms and water, *Eng.* Feb. 25-7; mineral, mach., Health exhib. *Eng.* Nov. 7, 28-4; motions of, two, Reynolds, *Van Nost.* July-4; *Nature*; motors, Unwin, *Eng. News*, May 9-5; do. do. *Van Nost.* Jan.-6; do. do. *The Eng.* Apr. 10-5; do. small, *Iron Age*, July 1-6; do. Amherst, *Mech.* Apr; do. press. engs., n. Nov.-5; do. expts. *Am. Eng.* Apr. 17-5; do. small, effic. of, June 17, July 28, Sep. 22-6; do. Balance, Allin, *Sci. Am. Sup.* Sep. 4-6; do. *Eng.* Apr. 10-5; do. Allin's, *The Eng.* Oct. 23-5.

WATER PIPES, 42 in., casting and testing at Widnes foundry, England, *Eng. News*, Dec. 22-3; cast iron, prices chart, '72-'84, Jan. 31; coated cast iron, spec., Boston, Feb. 21-5; scraper, Clayton, Apr. 10; laying, Prov. May 1; steel, Watson, Nov. 6; wrt. iron, H. Smith, Dec. 18; Howland, Dec. 18-6; wrt. iron, large, Mar. 26; Apr. 30-7; water moving in, momentum of, *Iron Age*, Aug. 7-4; Howland, Jan. 6-7; water in, momentum and force of impact of, Nystrom, *Mech.* Aug.-4; air valve, Dibble, Aug-5; cast iron spec., Fall R. w. wks., Harlow, *Am. Eng.* Nov. 7; flow w. thro., Stearns, Nov. 7; flow thro. hose, Weston, Nov. 21; friction in fire hose, Dec. 5-4; force of ram in, Weston, Jan. 2; throttle valve, self-acting, Oct. 22-5; tarred cast iron, May 13-6; press. reg., Curtis', Apr. 20; Howland, Apr. 20, 27, May 4-7.

" PIPES, lead, Nichols, *San. Eng.* Nov. 22-3; conduit, wrt. iron, H. Smith, June 20; iron, cement lined, Nov. 20; Howland, Dec. 25-6; cast iron, thickness, table, Jan. 1-7; 30 in. flexible, under Thames r. *Sci. Am. Sup.* Nov. 22-4; galv. iron, Venable, Apr. 25-5; wrt. iron, H. Smith, June 26-6; Howland, Feb. 12, Nov. 5; cast iron, wts., table, Sep. 10-7; conduit, wrt. iron, *Eng.* July 9-6; concrete, machs., Hamilton's, *The Eng.* May 18-3; flow w. thro., expts., Stearns, Oct. 24-4; do. Unwin, Jan. 1; do. Darcy's expts., do. May 7-6; do. formula and tables, H. Robinson, Dec. 16-7.

" POWER, Niagara Falls and r. *Eng. News* Oct. 13; of So. Atlantic slope, Swain, Nov. 10-3; of U. S. Sep. 4-6; Niag. r. Nov. 19-7.

WATER POWER, and stm. power, U. S. *Iron Age*, Mar. 6-**4**; at Niag. f., McElroy, *Am. Eng.* Oct. 15-**5**; do. util. of, n. Sep. 1-**6**; of U. S., govt. rep. *San. Eng.* July 15-**6**; of So. Atlantic slope, Swain. *Van Nost.* Nov.-**3**; Holyoke, Mass. Apr.-**6**; ht. of falls, U. S. *Elec. Rev.* Sep. 27-**3**; Niag. f. util., Rhodes, *Elec. World*, June 28-**4**; with high press. and wrt. iron pipe, hurdy-gurdy wheel, etc., H. Smith, *Sci. Am. Sup.* Sep. 13, 20-**4**; Niag. f., McElroy, Nov. 14-**5**; of U. S., D. Porter, *Soc. Arts*, Feb. 10-**7**; siphon, large, Norway, *Eng.* July 8-**7**; *The Eng.* June 27-**4**.

" PRESSURE, in soil, *Iron Age*, Aug. 12-**6**; do. *The Eng.* July 23-**6**; reg., Curtis, Apr. 28-**7**; do. *San. Eng.* July 30-**5**; proofing, *Eng. News*, Dec. 1-**3**; pumping, *Am. Eng.* May 20, June 10-**6**. See also PUMPING ENGS; STEAM PUMPS.

" PURIFICATION, by iron, Anderson, *Eng. News*, Feb. 14; do. ap. do. June 6; do. do. Sep. 5; do. Ogston, Sep. 5-**5**; do. Anderson, Jan. 1; Stanhope, Aug. 27-**7**; by iron, *Iron Age*, Apr. 23-**5**; do. Anderson, *Mech.* Apr.-**5**; removing micro-organisms from, Frankland, *San.Eng.* Aug.6-**5**; for domestic and mfg. purposes, Crane, June 24, Sep. 30, Oct. 7; its biolog. and chem. basis, Frankland, Nov. 13-**6**; do. do. *Van Nost.* Oct, Nov.-**6**; Hyatt, *Sci. Am. Sup.* Oct. 18; Stanhope purifier,Dec. 6-**4**; ap., Anderson's, June 20; do. for indus. purposes, June 27; by iron, on large scale, W. Anderson, July 18-**5**; Job's conundrum, Conant, May 22; by alum, Austen, July 17-**6**; by agit. with iron and sand filtration, Anderson, Feb. 12; supply, A. R. Leeds, Mar. 5-**7**; ap., Anderson, *Eng.* May 8; sea, making potable, May 22-**5**; ap., Anderson's, *The Eng.* May 8-**5**; Howatson's, May 21; by agt. with iron and sand filtration, W. Anderson, Dec. 3-**6**.

" RAINFALL, max. rates, Boston, chart, Fitzgerald, *Eng. News*, May 31; obs., N. E. Meteorol. Soc. Nov. 8-**4**; effect of wind current on, Curtis, Jan. 3-**5**; Oct., U. S. Dec. 24-**7**; max. *Am. Eng.* May 8-**5**; and evap., Brackett, *San Eng.* Dec. 4-**6**; an., L. Cochituate, Mass. *Ry. Gaz.* June 12-**5**; discharge of streams in relation to, Coghlan, *Van Nost.* July-**4**; hydro-mechanics, Evans, *The Eng.* Jan. 30-**5**.

" RAIN GAUGE, self-recording, Jacob's, *Sci. Am. Sup.* Nov. 15-**4**; do. do. *The Eng.* Oct. 3-**4**; London rains, comp. of, Russell, *Eng. News*, May 9-**5**; rain-separator, Robert's, *San. Eng.* Mar. 5-**7**.

WATER, raising, expenditure of H. P. in, *Iron Age*, Oct. 7-**6**; do. machs., Holland, Cuppari, *Van Nost.* Oct.-**4**; do. screw, Grulet's, *Sci. Am. Sup.* Dec. 13-**4**; do. machs. July 16-**7**; do. do. *The Eng.* Mar. 25-**7**; reservoirs, for railroads, mills, etc., Balcom, *Eng. News*, May 7-**7**; do. iron plate, Forchheimer, *Sci. Am. Sup.* Aug. 28-**6**. See also WATER WORKS.

" SATURATOR, cascade, for carb. acid gas, Mondollet, *Sci. Am. Sup.* Feb. 17-**3**; service, of Paris, *Eng. News*, Apr. 9-**7**; and sewerage sys., Denver, san. matters in West, *San. Eng.* July 29-**6**; softener, Stanhope, *Eng. News*, Aug. 27-**7**; do. *Sci. Am. Sup.* Dec. 6-**4**; do. *Eng.* May 22-**5**; softening of, Latham, *Eng. News*, Jan. 31, Feb. 7-**5**; do. do. *Van Nost.* Oct.-**4**; do. do. *Bu. News*; do. ap., Lavis, *Sci. Am. Sup.* July 7-**3**; Maignen's ap. *The Eng.* Oct. 24-**4**; softening by Clark proc. Oct. 21-**7**; spring, carb. acid in mineral, Redlich, *Sci. Am Sup.* Aug. 7-**6**; stand pipes, *Eng. News*, Oct. 30-**6**, see also WATER WKS; and stm power, census stat. *Mech.* Feb. 23-**4**.

" SUPPLY. See also WATER WORKS; filtration, in Am., Croes, *Eng. News*, June 16; of ancient cities, Atlee, Oct. 27-**3**; rural, Hett, Mar. 15, Apr. 5, May 10, 17; and waste in cities, Ludlow, June 21; lead pipes, use for, Aug. 30; dual, and distrib., Marten, Sep. 13-**4**; development of drainage areas, June 13; windmills for, Dec. 5-**5**; sys. Mar. 13; spongilla in main pipes, Fitzgerald, Aug. 7; rainfall, do. Aug. 21-**6**; low press., C. W. Baker, Aug. 14; sub-surface, Trowbridge, May 21; development for small cities in West, Kiersted, Dec. 24, 31-**7**.

" SUPPLY of cities, ancient, *Iron Age*, Nov. 1, 8-**3**; do. ancient Roman eities, Corfield, *San. Eng.* Aug. 6-**5**; do. do. *Van Nost.* Oct.-**5**; do. do. *Bu. News*; do. do. *Sci. Am. Sup.* Dec. 19-**5**; do. do. *Am. Eng.* Sep. 17-**5**; Coats, Mar. 21, 21, 28; and Allegheny r. water, Phillips, Mar. 28; and gas sup., various cities, table, n. Apr. 4-**4**; by driven wells, for large cites, *San. Eng.* Dec. 6-**3**; systems, July 17-**4**; ground water as a source of, Mar. 18-**6**; sub-surface, W. P. Trowbridge, May 28; by driven well sys., Noyes, Aug. 6, 13-**7**; do. W. P. Trowbridge, *Eng. & Bu. Rec.* Dec. 6-**7**; Topley, *Van Nost.* Nov; Mansargh, Dec.-**4**; Pole, Feb; of some great cities, Apr.-**6**; do. *The Builder*; sci. of, *Van Nost.* July; and cholera, Higgin, Aug.-**6**; do. *Nature*.

WATER SUPPLY, waste of water, England, Binnie, *Ry. & Eng.* Feb.-**7**; do. *The Eng*; of cities in ancient times, *Fran. Inst.* Oct.-**3**; clarification and purific., Gardner, *Sci. Am. Sup.* Oct. 10-**5**.

" SUPPLY, in desert, Suakim-Berber, *Eng.* Mar. 6; Pole, Mar. 20; Roman cities, Sep. 4-**5**; from wells, Inst. C. E., Grover, Fox, Stooke, Matthews, Apr. 22; village, Terry, Dec. 2-**7**; (small towns), Wallingford, *The Eng.* Feb. 12; Apr. 30; waste of, in town, Nov. 26-**6**; Attleboro, Mass. *San. Eng.* Jan. 29-**7**; Baltimore, *Eng. News*, May 24-**4**; Berlin, n. *Van Nost.* July-**6**; *The Eng*; Birmingham, Aug. 26; Bombay, Tansa wks., W. Clarke, eng. July 15-**7**; Boston, n. *Eng. News*, May 10, 10-**4**; Breslau, bk. rev. *San. Eng.* Aug. 6-**5**; Chicago, *Eng. News*, Feb. 5-**7**; and main drainage, *Am. Eng.* Sep. 3, 24-**5**; and drainage, prelim. rep. *San. Eng.* Feb. 12; Mar. 5-**7**; England, Latham, *Eng. News*, July 5-**4**; Glasgow, chem. anal. of, table, *San. Eng.* July 23-**5**; and Loch Katrine, *The Eng.* Feb. 20-**5**; West Gloucestershire, July 15-**7**; Leeds, England, purific. of, *Fran. Inst.* Feb.-**7**; Liverpool, *The Eng.* Jan. 14, 28-**7**.

" SUPPLY, LONDON, *Eng. News*, May 3; (Met.), Le Grand, June 14; for fire extinct., Greathead, Sep. 27-**4**; chem. anal. Aug. 29; tests, Dec. 26-**5**; *San. Eng.* Jan. 3-17, Feb. 7-**4**; Met. *Eng.* Sep. 5; Health exhib. Oct. 24, 31-**4**; Met. Sep. 11, Oct. 9, Nov. 6, Dec. 4-**5**; do. Jan. 1, 29, tests, Mar. 5-**6**; *The Eng.* Apr. 18-**4**; Mass., State Bd. Health, rep. *Eng. News*, Dec. 8-**3**; Memphis, *San. Eng.* Dec. 25-**6**; Mexico, and sewerage of mt. cities, *Eng. News*, July 12-**4**; Blake, *Sci. Am. Sup.* Aug. 9-**4**; Montpelier, Vt. *Eng. News*, May 22-**6**; Moscow, Rus. Apr. 4-**5**.

" SUPPLY, NEW YORK CITY (Met.), *Eng. News*, Apr. 12-**4**; Adirondack, for N. Y. c. Jan. 24-**5**; *San. Eng.* Feb. &c; Croton aqued. Nov. 12-**3**; Parrott, *Sci. Am. Sup.* Sep. 4; aqued. Sep. 25-**6**; Paris, *Eng. News*, June 13-**5**; Philadelphia, Schuylkill r., bad qual. July 21-**3**, Mar. 22-**4**, July 11-**5**; do. qual. Sep. 3-**7**; *San. Eng.* Nov. 27-**6**; *Fran. Inst.* June, Aug.-Oct.-**4**; July-**5**; Hering, rep. Jan; and rainfall, Birkinbine, Apr; rep. Aug.-**7**; Ramapo, N. Y. *Eng. News*, May 12-**3**; Roman, old, Apr. 18-**5**; San Francisco, Flynn, *Van Nost.* Nov.-**3**; Soudan, *Eng. News*, Apr. 18-**5**; Utica, N. Y., C. F. Carpenter, Jan. 19-**4**; Venice, Nov. 14-**5**; and sewerage of, *San. Eng.* Oct. 1-**5**; *Van Nost.* Sep.-**4**.

WATER, surface, safety in use of, *Eng. News*, Sep. 4; tank, aut. flush, Rosewater, July 17-6; temps., Am. Soc. C. E. Apr. 26-4; test, Koch's bacterialogical, *Eng.* Dec. 23-7; tower, see WATER WORKS TOWERS; valve, large, *Eng. News*, Dec. 13-4; do. Marichal's, *Am. Eng.* Sep. 8-6; do. cistern, high press., Mann's, *The Eng.* Feb. 12-6; do. Dennis' fullway, Mar. 25-7; wt. of cu. ft. at different temps., diagram, *San. Eng.* May 28-5; do. *Locom.* Nov.-7; waste of, T. J. Bell, *Eng. News*, Sep. 8-3; do. prevention, Boston, Oct. 18-4; do. do. Frankfort-on-Main, Ger., Gerhard, May 2-5; do. checking of, in Boston, *San. Eng.* Nov. 13-4; do. prevention and plumbing appliances, Coyne, Sep. 9-6; weir measurements, *Mech.* Jan. 12-4; wheels, overshot, *Iron Age*, Sep. 2-6; do. impulse, hurdy-gurdy, R. E. Browne, *Mech.* Oct. 27-3; do. the overshot, Sep.-5; do. plant, Niag. Falls, *Am. Eng.* Oct. 24, Dec. 12-4; do. Laxey, Isle of Man, England, *San. Eng.* July 23-7; ideal, Atkins, *Power & Trans.* June-6; do. and turbine govs., King's, *Eng.* Jan. 26-3; do. govs., aut., do. *The Eng.* Apr. 13-3; do. n. Jan. 11-4. See also TURBINES.

" WORKS, see also WATER SUPPLY; aqueduct, cleaning, Fitzgerald, *Eng. News*, Apr. 26; on high embankments, do. May 3-4; hydrant service rental, C. E. Chandler, Nov. 19; concrete mixing, Boston, Dec. 24-7.

" WORKS, AM., hist. and stat., Croes, *Eng. News*, Jan. 6, &c.-3; do. do. Jan.–June 13, 27, July 11, 18, Aug. 1, 15, 22, Sep. 5, 26, Oct. 3–31-5; do. do. Jan. 23, 30, Feb. 20, Mar. 6, 20, Apr. 3, 10, 24, May 15; do. stat. tables, Oct. 30, Nov. 6-6.

" WORKS, Am. Assoc., pro. *Eng. News*, Apr. 26-4; July 3-6; July 20-7; *San. Eng.* July 8-6; July 23-7; N. E. Assoc., pro. *Eng. News*, Sep. 29-3; June 26-6; *San. Eng.* June 24-6; June 25-7; Amsterdam, *The Eng.* Nov. 5–19-6; anchor ice, flow stoppage by, Francis, *Iron Age*, Aug. 25-7; inlet protection against, *Am. Eng.* Nov. 2-7; Antwerp, *Van Nost.* Mar.-3; Aurora, Ill., spec. *San. Eng.* July 9-5; Bay City, Mich. *Eng. News*, Feb. 23-4; *San. Eng.* Apr. 2-7; Belfast, *Eng.* Dec. 17-6; Birmingham, Aug. 3-3; *The Eng.* Aug. 10-3.

" WORKS, Boston, contract prices, *Eng. News*, Mar. 31; rep. Sep. 15; Dec. 22-3; Fisher Hill reservoir, rep. Oct. 10-5; Feb. 6–27-6; rep. Feb. 19; foundations and chimney, prices, Mar. 5-7; Fisher Hill res., bids, *San. Eng.* Oct. 8-5.

WATER WORKS, Boston, res. evap., Fitzgerald, *Van Nost.* July-6; Bradford, England (small town supply), *The Eng.* May 25, June 8-3; Bridgeport, Conn. *Eng. News*, Apr. 9-7; Brooklyn, Dec.5-5.

" WORKS, Calais, Me. *Eng. & Bu. Rec.* Oct. 8-7; Calcutta, India, *Eng. News*, Dec. 17-7; *Eng.* Apr. 30-6; Cambridge, Mass., Stony brook sup. *San. Eng.* Nov. 20-6; Carlisle, England, Jan. 29-7; Charlottesville, Va., Bolton, *Sci. Am. Sup.* Mar. 13-6; Chicago, tunnel, *Eng. & Bu. Rec.* Oct. 29-7; Clinton, N.Y., Baxter, *Eng. News*, Feb. 28-5; Coblenz, Ger., driven by Otto gas engs. *Iron Age*, May 19-7; Cohoes, *San. Eng.* Jan. 29-7; Congleton, small town supply, *The Eng.* May 18-3; Constantinople Briffault, *San. Eng.* Jan. 29-7.

" WORKS CONSTRUCTION, notes, *Eng. News* files; lifting a 40-in. main, Boston, Jan. 23; prices, Croton aq. Jan. 30; do. main laying, N. Y. Mar. 13-6; in U. S. Feb. 26; stat. May 28; and management, June 18; and stat. July 23, 30, Aug. 6, Sep. 3, Oct. 1, Dec. 17, 24-7; masonry in shafts and under press. *San. Eng.* June 11-5; Watertown, Mass. Sep. 30; Cambridge, Mass. Nov. 20; Gardiner, Me. Dec. 18-6; Charlottesville, Va. May 21, 28; Ware, Mass. July 16; details, Billings, Sep. 24-7; do. do. *Eng & Bu. Rec.* Oct. 15, 22, Nov. 19, Dec. 10; Calais, Me. Oct. 8; Cohasset, Dec. 3-7. See also WATER WORKS, N. Y., etc.

" WORKS, cost of raising small quans. by stm. pumps, *Eng. News*, Oct. 9-6; Croton, see WATER WORKS, NEW YORK; Dover, N. H. Nov. 26-7; Dutton sluices, *Eng.* Dec. 19-4; early, *Mech.* Sep.-5; East Orange and Bloomfield, N. J. *San. Eng.* June 25-7; Edinburgh, *Eng. News* June 23-3; *Eng.* June 1-3; July 29, Aug. 19-7; Leslie, *The Eng.* June 15-3; Aug. 5-7; flush tank, Morrison, *Eng. News*, Apr. 3-6; Galveston, Tex. Mar. 3-3; Genoa, Italy, n. Dec. 18-6; Harlem sub. aqued. *Mech.* Nov.-6; head gate, roller cnrtaln, Foote, *Eng. News*, Dec. 11-6; Hyde Park, *San. Eng.* Jan. 7-6; Jersey, Burstall, *Eng.* July 8, 22-7; Kansas City, map, Pearsons, *Eng. News*, Nov. 5-26, Dec. 3, 17, 24-7; Katatbeh, Egypt, *Sci. Am. Sup.* Apr. 30-7; Kimberly, engs. duty, *Eng.* June 13-4; Lawrencc, Mass., H. W. Rogers, *San. Eng.* Mar. 12-7; Lawrenceville, N. J. Dec. 4; Liberty, Va. Jan. 21-6; Limpsfield and Oxtead, *The Eng.* Sep. 2-7; Liverpool, Deacon, rep. *Eng. News*, Oct. 3-5; *San. Eng.* June 17-5.

WATER WORKS, Liverpool, Vyrnwy r. sup. *San. Eng.* Oct. 25-**3**; do. *The Eng.* Oct. 16-**5**; London, Bolton, rep. *Eng. News*, Apr. 25; stat. Aug. 15; Marblehead, Mass., iron reservoir, Nov. 21-**5**; Matlock-Bath, *The Eng.* Aug. 15-**4**; milling, *Sci. Am. Sup.* Oct. 22-**7**; Milwaukee, pub. *Eng. News*, Aug. 25-**3**; Naples, Italy, *Am. Eng.* Feb. 11-**6**; Nashville, Tenn. *Eng. News*, July 19-**4**.

" WORKS, NEW YORK CITY, Croton aqued., rep. *Eng. News*, Mar. 17; Aug. 11, 25-**3**; map, Dec. 6-**4**; spec. Mar. 7, 14, prices 21; July 11-**5**; Jan. 9, 23, construct. prices 30; ventil. May 29; gate h. Oct. 30; one years prog. Dec. 18-**6**; bids, Jan. 22; prices for, Feb. 5, 19; July 30; rep. Aug. 13-**7**; *Iron Age*, Dec. 25-**4**; July 7-**7**; water sheds, map, *San. Eng.* Mar. 26; Apr. 30; tunnel, May 21; engs. es. and spec., table, Aug. 6-**5**; tunnel under Harlem r. Feb. 25, Mar. 11, 18; san. inspect. of, May 27; June 17, Aug. 19, Nov. 13-**6**; map, Feb. 5, 19; June 11; Aug. 13; tipple cars on, Aug. 13; accident on, Oct. 1-**7**; location of plant, *Eng. & Bu. Rec.* Nov. 12-**7**; *Sci. Am. Sup.* Jan. 10-**5**; *Eng.* Feb. 26-**6**. See also TUNNELS, CROTON AQUED.

" WORKS, Nottingham, England, *San. Eng.* Oct. 15-**5**; *The Eng.* June 15-**3**; covered reservoir, Tarbotton, July 10-**5**; Paris, *Mech.* Apr.-**7**; Peterborough, Addy, *The Eng.* June 15-**3**; Philadelphia, *Eng. News*, Jan. 6, 27-**3**; May 24, 24-**4**; Belmont submerged main, De Kinder, rep. Mar. 28; topog. surveys, Allen, Mar. 28; rep., '84, Oct. 3-**5**; rep. Aug. 28-**6**; Feb. 12; early Am. Apr. 23; rep. Aug. 27-**7**; Pittsburg, rep. Jan. 17-**5**; Port Elizabeth, So. Africa, Gamble, *The Eng.* June 15-**3**; Poughkeepsie, rep. *San. Eng.* Apr. 9-**7**; press. in mains, varios cities, table, Croes, *Eng. News*, Jan. 9–30, Feb. 6–27, Mar. 6, 20, 27, Apr. 3–24, June 5, 26, July 17; Providence, Apr. 24-**6**; pumping, direct and reser. sys. compared, July 12-**4**; rates, Sep. 5; Red Bank, well and pumping mach. Aug. 29-**5**; Remscheid, pumping station, *The Eng.* Mar. 20, 27; Apr. 10-**5**; reports, *Eng. News*, June 27-**5**; '83, *San. Eng.* July 24-**4**.

" WORKS, RESERVOIRS, Villar, Lozoya r., Manby, *Eng. News*, Feb. 24; broken, at Knoxville, Tenn. July 21-**3**; in limestone countries, E. F. Fuller, Feb. 23-**4**; failure, Cleveland, O. Dec. 25-**6**; Little Rock, broken, Nov. 12; storage, open or closed, Beach, Dec. 3-**7**.

WATER WORKS, RESERVOIRS, Northwestern sys., Pyle, *Eng. News*, Oct. 3-5; do. *Harpers*,-4; evap. from, expts. *Iron Age*, May 20-6; walls construct. *Am. Eng.* June 8-7; Beacon Hill, slope slipping, Lowell, *San. Eng.* Jan. 14-6; storage, should they be open or closed, Beach, July 23; Molteno, Cape Town, Africa, C. J. Wood, Aug. 27-7; constrnct., Kraft, *Van Nost.* July; storage, capac. of, Rippe, July-3; covered service, Morris, Feb.-4; breaks, remarkable, Lukens, *Locom.* Aug.-7; Stratford-on-Avon, *The Eng.* Nov.27-5; Maligakauda.Mar. 18-7. See also DAMS.

" WORKS, Rosario, engs. and pumps, Easton, eng. *The Eng.* May 14, 14-6; Samaria, Russia, *Eng. News*, July 30-7; service pipes, Richards, June 28-4; Sholapur, Burke, *The Eng.* Jan. 4-4; small, Henley, Church, eng. Jan. 5; for towns, July 20-3; specs., and sewerage, Shreveport, *Eng. News*, June 19-6; Southampton, *The Eng.* Oct. 30-5; Southington, Conn. *San.Eng.* Feb. 18-5; Southwark & Vauxhall, Hampton, Restler, sng. *The Eng.* July 15-7; St. Helens, Knowsley pumping station, Apr. 10, May 29, June 5-5; St. Pierre mine, Creusot Co., France, *Mech.* Apr. 19-4; stand pipes, Ward, *Eng. News*, July 24; do. notes, Sep. 18; do. July 2-7; do. Sandusky, O. Nov. 13-6; do. do. *San. Eng.* Feb. 12-7; do. destruction, *Eng.* Jan.-7; Taunton, Mass. *Eng. News*, Feb. 9-4; *San Eng.* July 3-4; towers, Princeton, N. J. *Eng. News*, Dec. 1-3; do. Yonkers, N. Y. Oct. 18-4; do. Gravesend, L. I., failure, Oct. 23; do. Weehawken, N. J. Nov. 6-6; do. Asbury Park, *San. Eng.* Sep. 2; do. Gravesend, bursting of, Oct. 23, Dec. 18-6; at Kankakee, Ill., fall of, Jan. 1-7; breakages, *Eng. & Bu. Rec.* Nov. 5, 12-7; do. Colchester, *The Eng.* Feb. 15-4; Venice, *Iron Age*, Nov. 6-4; Washington, aqued. *Eng. News*, Feb. 14-5; Sep. 18-6; Waterbury, Conn. *San. Eng.* Apr. 8-5; Wein, Stooke, eng. *The Eng.* Sep. 18-5; Wellesley, Mass., Fuller, rep. *Eng. News*, Oct. 10-5; Whitacre, Birmingham, *Eng.* Sep. 25-5; Widnes, H. Davey, eng. *The Eng.* Aug. 26-7; Yokohama, *Eng. News*, Aug. 14-6.

WATT, JAMES, inventions of, Cowper, *Mech.* Jan. 12,19, Feb. 2-4.

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WEIGHTS AND MEASURES, English meas. *Eng. News*, Dec. 22-**3**; Roger's Bond comparator mach. *Mech.* Jan. 27; Milbrough meas. mach., Whitworth, Feb. 3; French (scale) comparator, Sep. 15; Anglo-Saxon metrology, Sep. 22-**3**; length standards, Bond, *Am. Eng.* May 23, 30 and before, June 6–27, July 4–18-**4**; Brit. and metric standards, Smythe, *Van Nost.* Sep.–Nov; slide rule, Boys, Dec; standards, Culley, Dec.-**5**; do., *Fran. Inst.* Apr, May-**4**; metric sys. *Elec. Rev.* July 26-**3**; standard and metric units, June 26-**6**; French and English, June 18-**7**; Internal Bureau observatory, *Sci. Am. Sup.* Oct. 20-**3**; do. Feb. 23-**4**; Brit. and metric, comparison for eng. purposes, A. H. Smythe, Mar. 14-**5**; metric, and old units, F. Brooks, Aug. 14-**6**; dividing eng. for standard lengths, *Eng.* Sep. 3-**6**; standards of length, Bond, July 11, 25, Aug. 15-**4**; do. do. *The Eng.* June 5, 12, and their subdivision, Feb. 20, Mar. 6-**5**; French and English, conversion table for, sup. Feb. 5, Mar. 19-**6**; units of wt., mass and force, Apr. 1-**7**.

WELCH, ASHBEL, por. *Eng. News*, Jan. 20-**3**.

WELLS, ancient. Latham, *Eng. News*, Sep. 3-**7**; artesian, Bourn, Lincolnshire, England, Pilbrew, Dec. 27-**4**; do., Darley, July 25, Aug. 8-**5**; do. Nev. *Iron Age*, Nov. 13-**4**; do. do. *Mech.* Nov; do., N. Y. May 24; do., boring tools, Aug.-**4**; do. of Denver, Am. Soc. C. E. rep. *San. Eng.* Aug. 12; do. premature spouting, Sep. 9; do., on N. J. coast, Sep. 16-**6**; do. in Iowa, Oct. 1-**7**; do. Pomona, Cal. *Sci. Am. Sup.* Jan. 10; do. at Fort Scott, Kan. Feb. 21; do. Darley, Sep. 12-**5**; do. Chamberlin, May 22, 29, June 5-**6**; do., U. S., Darley, *Eng.* June 19, 26-**5**.

WELLS, driven, pat., Green, *Eng. News*, Sep. 22-3; do. *Iron Age*, May 26-7; do., for water sup., W. P. Trowbridge, *San. Eng.* Dec. 6-3; do. at Hertford, England, Sep. 23-6; do., Hoadley, Dec. 4-25-4; do. do., *Soc. Arts*, May 10-3; do. sys., Brooklyn, *Sci. Am. Sup.* Jan. 12-4.

" LINING, *Eng. News*, June 14-4; digging pneu., Russia, July 30-7; deepest bore hole, n. *Van Nost.* June 6; do. *Iron Age*, July 2; Rouse's point, July 2-5; bore tube drilling mach., Merryweather, *Mech.* May-5; bore hole test and ap., clinograph, MacGeorge's, *Eng.* Mar. 13, Apr. 3-5; do. do. *Sci. Am. Sup.* Oct. 10-5; boring by stm., with spring pole, Lyman, Mar. 27-6; tube, Abyssinian, Le Grand, eng. *The Eng.* Oct. 24-3; curbs, Ind. St. Rys. Jan. 9; boring tools, Parson's, June 12-5.

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WILLIAM I, King Prussia and German Emperor, por. *Sci. Am. Sup.* Apr. 30-7.

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" ENGINE, Kirkwood, *Iron Age*, Jan. 6-7; railroad, Strong, *Mech.* Oct. 20-3.

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WINDING ENGINES, Imp. Coal mines, Japan, *Eng.* Sep. 28-**3**; portable, Spencer, eng. *The Eng.* May 15; comp., Dick's, June 12-**5**; and indic. gear, Tangye, Jan. 4-**6**.

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" GAUGE, Standard Imperial, *Eng. News*, Mar. 1-**4**; *Iron Age*, Aug. 2; standard, Grt. Brit. Oct. 11-**3**; Brit. Mar. 6-**4**; standard, *Mech.* Jan. 6; do. Grt. Brit. Oct. 27-**3**; do. Mar. 8-**4**; do. Brit. Nov.-**7**; Brit. *Ry. Gaz.* Sep. 21-**3**; standard, England, *Van Nost.* Nov.-**3**; B. G. May-**4**; standard sys., a, *Fran. Inst.* May-**3**; do. Brit. Aug.-**4**; Am., diams., Hering, *Electric.* Apr; table of all, do. May, correction, June; standard, Sep.-**6**; Nat. Elec. Light Assoc., proposed, July; do. standard, rep. Sep.-**7**; Brit. standard, *Elec. Rev.* Aug. 23-**4**; Nat. Teleph. Assoc., Feb. 6-**6**; metric, table, sup. Aug. 20; discuss. Sep. 3; do. Nat. Teleph. Exch. Oct. 8-**7**; *Elec. World*, Mar. 14; standard, Sep. 26-**5**; do. internat. June 19, 26-**6**; Murdock, Dec. 10-**7**; legal standard, England, *Eng.* Sep. 7-**3**; standard, Feb. 8-**4**; Trotter, Mar. 19-**6**; *The Eng.* Oct. 26-**3**; standard, Feb. 8-**4**.

" MILLS, and rod mills, of U. S. *Iron Age*, Feb. 8-**3**; do. Am. Nov. 19, Dec. 17-**5**; do. Iowa barbed, Oct. 20-**7**; nail mach., Hardman, Apr. 15; do. Sharon, Nov. 4; do. list, Apr. 15-**6**; rods, iron and steel, manuf., U. S. Sep. 3-17-**5**.

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" TIMBER, creosoting, Tidy, *Am. Eng.* Jan. 4, 11; do. antiseptic treatment of, Boulton, July 11-**4**; woods and their decay, Dudley, Sep. 8-22-**6**; do. do. *Pop. Sci. M.* Aug, Sep.-**6**; lumber produc. and L. Superior traffic, *Ry. Gaz.* Mar. 13; timber preserv., Am. Soc. C. E. rep. June 12-**5**; do. Feb. 19; do. tie pressing wks., Laramie, U. Pac. R., Chanute, Oct. 29, Nov. 5-**6**; preserv. by antiseptic treat., Card, Aug. 5-**7**; bu. seasoning, *Van Nost.* Feb; Cuban, strength, etc., Estrada, Nov, Dec.-**3**; timber, antiseptic treat. of, Boulton, Dec.-**4**; do. do. do. July-Sep; creosote, Tidy, Dec.-**5**; timber, Apr.-**6**; do. *Bu. News*; preserv. by antiseptics, *Fran. Inst.* July-**6**; Nicaraguan, Flint's inves., Thurston, Oct.-**7**.

" LUMBER drier, Chicago, *Sci. Am. Sup.* Mar. 10-**3**; boxwood and its substitutes, J. R. Jackson, July 11; timber preserv., Am. Soc. C. E. rep. Oct. 24, 31, Nov. 7, 28-**5**; timber, Blashill, Apr. 3; do. measurement, Apr. 10-**6**; do. preserv., rep., *Locom.* July-**5**; do. do. kyanizing, *Eng.* Sep. 7-**3**; preserv. May 23; teak, Nov. 14, 21-**4**; preserv., creosoting, Boulton, Inv's exhib. May 1-**5**; pulp pails, Jan. 1, Sep. 2-**7**; timber, antiseptic treat. of, Boulton, *The Eng.* June 6-**4**; do. round, strength of, Preece, Oct. 30-**5**; do. at Ind. & Col. exhib., tests, Sep. 3-**6**.

" MOLDING KNIVES, *Mech.* Apr. 21-**3**; wagon spoke reproducing lathe, *Sci. Am. Sup.* Jan. 19-**4**; wool mach. Feb. 21-**5**.

" WORKING MACHS., and iron, *Iron Age* files; planing mach Oct. 14-**6**; do. Delern, French, *Mech.* May 26-**3**; planing mill, Keystone, *Ry. Gaz.* June 13-**4**.

WOOD WORKING MACHS., Richard's, *Eng.* Feb. 13; casks and barrels, Inv's exhib. Aug. 14; Inv's exhib. Oct. 30-5; Robinson's wks., Rochdale, *The Eng.* Nov. 14-4; working tools, power consumed by, W. L. Church, May 29-5.

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WOOLEN MILL, cloth working indus., econ. processes, Ramsay, *Sci. Am. Sup.* July 26-4.

WOOL OIL, acids of, *Sci. Am. Sup.* July 11-5.

" WASHING MACH. *Sci. Am. Sup.* July 7-3; Mehl's, Apr. 5-4.

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